JUNE 1957 Vol. 19 No. 7

MINING WORLD

How To Drill and Log Deep Uranium Holes Page 46

Tips For Pegmatite Mining And Prospecting Page 50

Underground in World's Largest Borax Mine

Page 36

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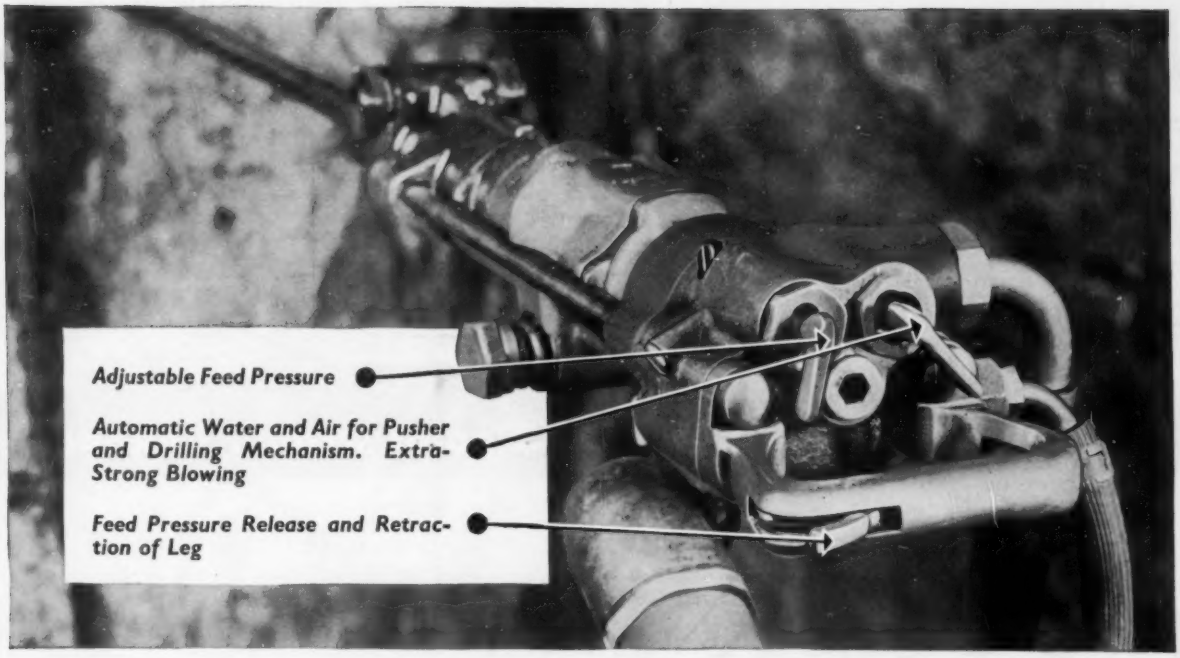
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Automatic Water and Air for Pusher and Drilling Mechanism. Extra-Strong Blowing
Feed Pressure Release and Retraction of Leg

THE ATLAS COPCO LION— A REVOLUTIONARY NEW ROCK DRILL

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The Atlas Copco Lion is the first drill to have all the valves which operate the drill under the control of one hand. *Full and easy control without having to move the hand from the backhead!* All the controls have been designed so that they are well protected. While using them the operator's hand is never near the wall or roof of the drift. The Lion is the first pusher leg drill with controls placed for drifting.

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U.S.—Atlas Copco Pacific, Inc., 930 Brittan Avenue, San Carlos, California, or Atlas Copco Eastern Inc., P.O. Box 2568, Paterson 25, N.J.

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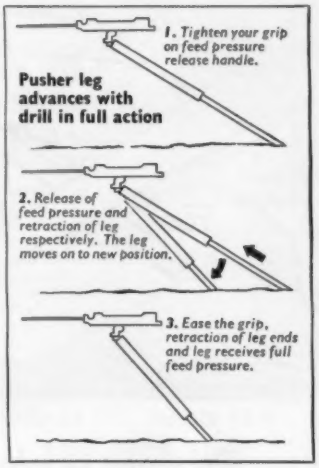
1. Tighten your grip on feed pressure release handle.
Pusher leg advances with drill in full action
2. Release of feed pressure and retraction of leg respectively. The leg moves on to new position.
3. Ease the grip, retraction of leg ends and leg receives full feed pressure.

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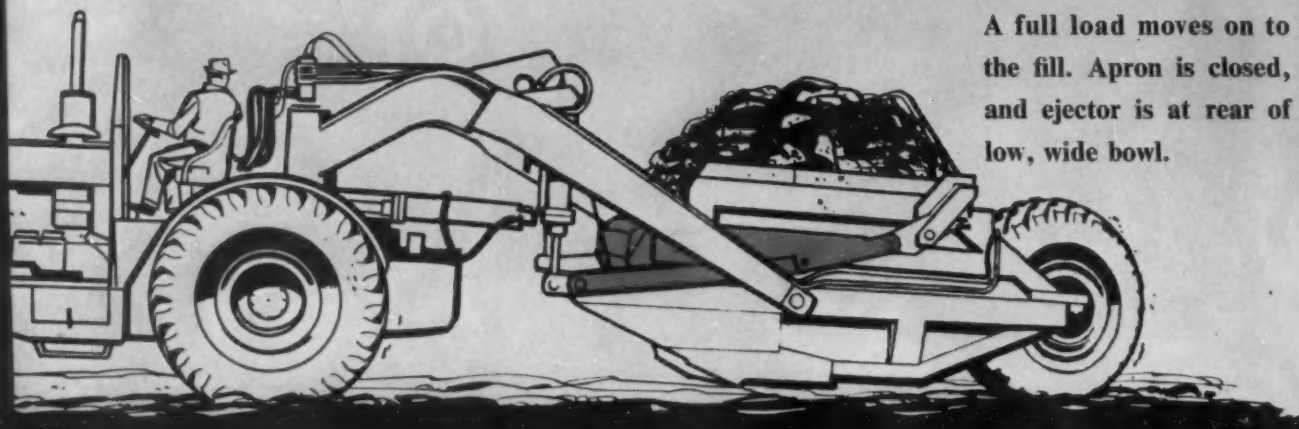
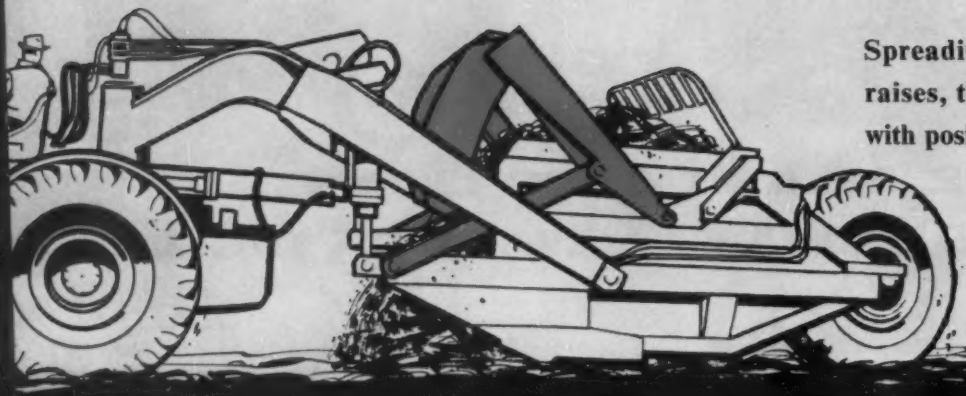


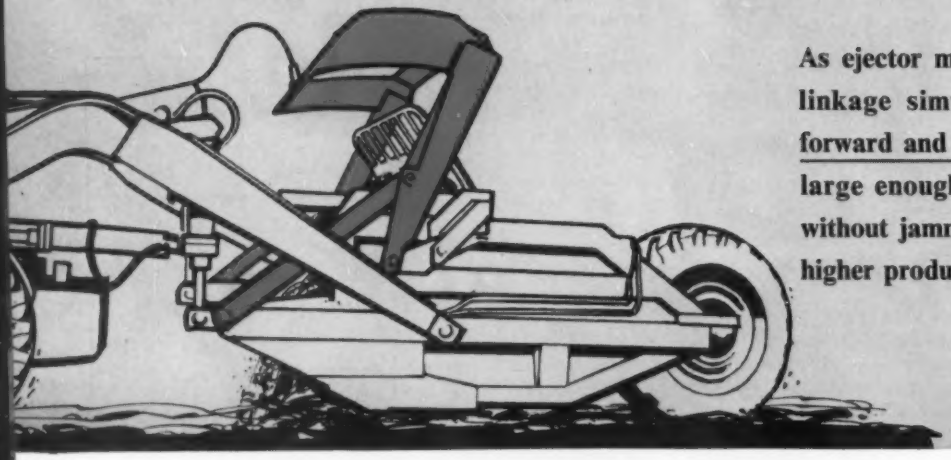
A full load moves on to the fill. Apron is closed, and ejector is at rear of low, wide bowl.

How Allis-Chalmers' patented 3-point scraper linkage



Spreading starts. As the apron raises, the ejector moves forward with positive force, accurate control.

assures fast, clean, controlled spreading of any material



As ejector moves toward cutting edge, linkage simultaneously moves apron forward and upward, providing opening large enough to let any load fall free without jamming. Result: faster cycles, higher production, more profit!

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Mining World

Including the Export Edition **WORLD MINING**

Published monthly except in April when publication is semi-monthly

VOLUME 19 **JUNE 1957** NO. 7

OPERATIONS-TECHNOLOGY

Mining

Pacific Coast Borax Enters New Era 36

By Stanley Dayton

A new open pit and a new $18,000,000 borax refinery at Boron, California are a long way from the original 20 Mule Team Borax. However, boron is now a jet age fuel and it takes big developments to keep pace with demand.

New Open Pit To Supply Growing Borax Demand 38

Pacific Coast Borax is now mining the world's largest known sodium borate ore body after stripping 137 feet of overburden. Ore will be auger drilled, blasted, and loaded with electric shovels.

Continuous Mining Machines Used Underground 40

These machines proved very successful in room and pillar stoping even though borate minerals are harder than coal.

What Uses Cause Demand For Borax To Grow? 43

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By E. P. Chapman, Jr.

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By Peter Weidner

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By J. S. Mitchell

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ON THE COVER

Though borate ore is harder than coal, the continuous mining machine shown on the cover of this issue proved completely successful at Pacific Coast Borax Company's underground mine at Boron, California.

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MINING WORLD, June, 1957. Volume 19, No. 7. Published monthly except April, when publication is semi-monthly at Emmett St., Bristol, Conn., Executive, advertising and editorial offices, 500 Howard Street, San Francisco 5, California. Subscription in United States, North, Central, and South America, $3.00 per year; other countries, $4.00 per year. Entered as second class matter Oct. 10, 1951 at the Post Office at Bristol, Conn., under the act of March 3, 1879. Postmaster: please send notice 3579 to MINING WORLD, 500 Howard Street, San Francisco 5, Calif.

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EDITORIAL AND EXECUTIVE OFFICES
500 Howard Street
San Francisco 5, Calif.
EXbrook 7-1881

General Manager .. M. F. Holsinger
Editor ..... George O. Argall, Jr.
Associate Editor .... Stanley Dayton
Mgr., Eng. Serv. .. H. G. Grundstedt
News Editor ..... Janet M. Taylor
Ass't News Editor L. A. Charbonneau
Product Editor ..... C. F. Hamilton
Production Manager . J. A. Cheesman
Circulation Manager ... C. B. Baake

New York City Office
370 Lexington Avenue
Murray Hill 3-9295
Dist. Mgr., New York .. A. E. Roberts

Chicago Office
1791 Howard Street
Rogers Park 4-3420

Dist. Mgr., Chicago ... R. N. Crosby

Vancouver Office
402 Pender St. West
MArine 7287

Assoc. Editor ..... Charles L. Shaw

STAFF CORRESPONDENTS: Africa—Johannesburg, Union of South Africa; Salisbury, Southern Rhodesia. **Asia**—Ankara, Turkey, Kuala Lumpur, Federated Malay States; Tavoy, Burma; Karachi, Pakistan; Seoul, Republic of Korea; Tokyo, Japan. **Europe**—London, England; Vienna, Austria; Stockholm, Sweden; Trondheim, Norway; Paris, France; Redruth, Cornwall. **North and Central America**—Mexico D. F., Mexico; Vancouver, British Columbia. **South America**—Sao Paulo, Brazil; La Paz, Bolivia; Lima, Peru; Bernal, Argentina. **Oceania**—Port Kembla, N. S. W., Australia; Manila, Philippine Islands.

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Published by American Trade Journals, Inc.
Wm. B. Freeman, President
L. K. Smith, Vice President
Miller Freeman, Jr., Sec-Treas.
WORLD MINING is published the 26th of each month as a regular department of MINING WORLD and is also circulated as a separate publication on a carefully controlled free basis to a selected list of management and supervisory personnel associated with active mining enterprises throughout the world.

Mining World Subscription Rates
U.S., North, South and Central America $3.00
Other Countries $4.00
Single Copies .....$ .50
Directory Number $1.00

CHANGE OF ADDRESS:
Send subscription orders and changes of address to MINING WORLD, 500 Howard St., San Francisco 5, Calif. Include both old and new addresses and zone numbers.

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Drifts and Crosscuts

A New Service For Readers

Is your copy of MINING WORLD a pass-along copy? If your answer is yes, you are a typical reader. You either point out to an associate engineer such and such an article, or you mark your copy for one of your staff to read. And in a typical reader's case you often find that one of your associates has marked his own private copy and passed it along to be sure that you don't miss that special money saving idea. Yes, many engineers subscribe to MINING WORLD and have it sent directly to their own homes for study and careful filing. They see and use the pass-along copies at the office too.

Now just about the most frustrating thing that can happen is to find out that some one beat you to the Production Equipment Preview (PEP Card) and has already mailed it to obtain details about that new automatic hole positioner. Anyhow, you were interested in the new flotation reagent.

To make it easier and more efficient for all readers, MINING WORLD inaugurated a new series of PEP cards in the April issue. Check the new card following page 82 of this issue. The master PEP card appears at the bottom so that it is still as easy as ever for you to circle the item numbers or write the page number in. Complete the card by listing your name and address and drop in any mail box. Please be sure and sign your name and address. Every day cards are returned without the name or address.

For the pass-along readers, or if you want information on just one piece of equipment, use the "Urgent" card and mail directly to the manufacturer.

For readers outside the United States the PEP card will continue to save them time and postage when combining several requests on the regular card. Remember that MINING WORLD pays postage only for cards mailed in the United States.

Yardstick for Uranium Production Cost

The rapid emergence of uranium cost and production data from behind the secrecy curtain now permits mining companies and investors to assay more accurately this growing segment of the mining industry. The April issue of MINING WORLD gave full details about South African uranium grades and profits for 26 mining companies.

The annual report (1956) for Pronto Uranium Mines Limited, first in production at Blind River, Canada, and typical for a smaller mine in that famed district, gives the following figures: tons of ore milled, 405,799; pounds U_3O_8 recovered per ton, 1.814; revenue per ton, $18.14; mining cost per ton, $4.38; milling cost, $5.49; profit before write offs, $6.05; and net profit per ton, $1.92. Mining cost per pound of uranium recovered was $2.42; milling, $3.02; and net profit, $1.06. These profits are comparable with those in South Africa.

They will be of interest to United States producers who have higher grade ores, but treat smaller tonnages. Pronto ore dips flatly; is hard and abrasive; is all mined underground, but stopes are large, 10 to 16 feet high for efficient mechanization.

The uranium miners can and will cut their costs and increase recovery to lower cost per pound. It can be done as evidenced by the remarkable operations of another Canadian company—MacLead-Cockshutt Gold Mines Limited—which underground mined and milled 614,848 tons of ore at its Little Long Lac mine in 1956 at a total operating cost of only $2.97 per ton.

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Western Precipitation Corporation pioneered the high-efficiency multiple-tube principle that has proven so superior it is now the pattern for the industry.

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Congress Has A Duty To Fulfill Its Commitments For Minerals Purchases

When the Congress passed the Mineral Purchase Act, Public Law 733, it certainly made a moral commitment to furnish enough money to complete the program. The Senate Appropriations Committee and the Senate have recognized this obligation, but the House Appropriations Committee and the House of Representatives, including the House leadership on both sides of the aisle, capriciously repudiated the commitment. The Administration has not. The Bureau of the Budget, early in the year, asked for $30,000,000 in the First Urgent Deficiency bill and $40,000,000 in the regular 1958 fiscal appropriation bill to carry the program to completion, and the Interior Department appeared before the committees and justified the appropriation.

The first move on the part of the House Appropriations Committee was to kick out the entire $30,000,000 from the First Urgent Deficiency bill and the House, having few western congressmen, went along. The House Appropriations committee even refused to hear a delegation of western Representatives in support of the appropriations. The Senate, feeling its obligation, promptly restored the $30,000,000. The House would not go along, the bill went to conference, where the House conferees were adamant, and the situation remained deadlocked until just before the Easter vacation recess, tying up a lot of funds for other necessary purposes.

In a surprise move, the House passed H. J. Res. 310, carrying appropriations for the non-controversial items in the First Urgent Deficiency bill, and sent it to the Senate, thus pulling the rug from under the Senate conferees. However, the Senate Appropriations Committee amended the resolution and added $9,100,000 to bridge the short time left until June 30, when the 1958 fiscal appropriations presumably would take over.

This amended bill was returned to the House and the temper of that body may be seen in the extraordinary action which took place. H. J. Res. 310 as amended was tabled, instead of being sent to conference, and within a couple of hours another bill, H. J. Res. 312, was passed and sent to the Senate, again eliminating all money for minerals.

The Senate had agreed to recess and most Senators had reservations to leave town (Representatives also) when Senator George Malone of Nevada obtained the Floor, stating he was prepared to talk until the snow was nine feet deep on Pennsylvania Avenue. He sent an amendment to the desk which would have corrected the situation and restored the appropriation. A real filibuster might have accomplished the purpose, but the snow melted too fast. Malone gave up, the amendment was never brought to a vote, and H. J. Res. 312 was passed as the House had passed it, with minor changes which were accepted by the House without conference. The only effect the Malone attempt had was to hold the Congress in session for an extra day, and, it is to be hoped, made a lot of House members lose their plane reservations in return for their unethical conduct.

The First Urgent Deficiency bill still is in conference and, unless the House Appropriations Committee changes its temper, is likely to stay there. H. J. Res. 310 would have to be taken off the table in the House by unanimous consent, and it is likely to stay there.

It appears as though the principal hope is to get at least part of the $40,000,000 in the fiscal 1958 appropriation bill, in which there may be some items the Senate can trade with the House—nothing is left to trade with in the First Urgent Deficiency bill.

All the hurrah appears to be over tungsten, which requires the bulk of the money, and which is the only mineral in P. L. 733 which is being overproduced.

Still, the Congress should keep its word and its commitments.

• House Bill Restricts Military Withdrawals

The bill to restrict military land withdrawals is now before the Senate Interior Committee, following House passage on April 11. The measure, (H. R. 5538) was introduced by Congressman Engle.

The two main provisions are that (1) no public land or water area "shall, except by Act of Congress," hereafter be withdrawn for use of the Department of Defense if such withdrawal would include "more than 5,000 acres in the aggregate for any one defense project or facility," and (2) all military withdrawals, except land reserved specifically as oil or coal reserves, shall be subject to the condition that all minerals in the lands may be disposed of only under the applicable public land mining and mineral leasing laws.

• Director Gray States ODM Manganese Policy

There has been a lot of pressure on the government to finance the beneficiation of the stocks of manganese ore accumulated by the General Services Administration.

Gordon Gray, director of the Office of Defense Mobilization, on April 18, 1957, delivered the following opinion which evidently is to be the policy of his agency:

"At the time this domestic support program was established, the United States was faced with the possibility of all-out war and very limited reserves of metallurgical manganese. Emergency efforts, therefore, were directed toward developing domestic

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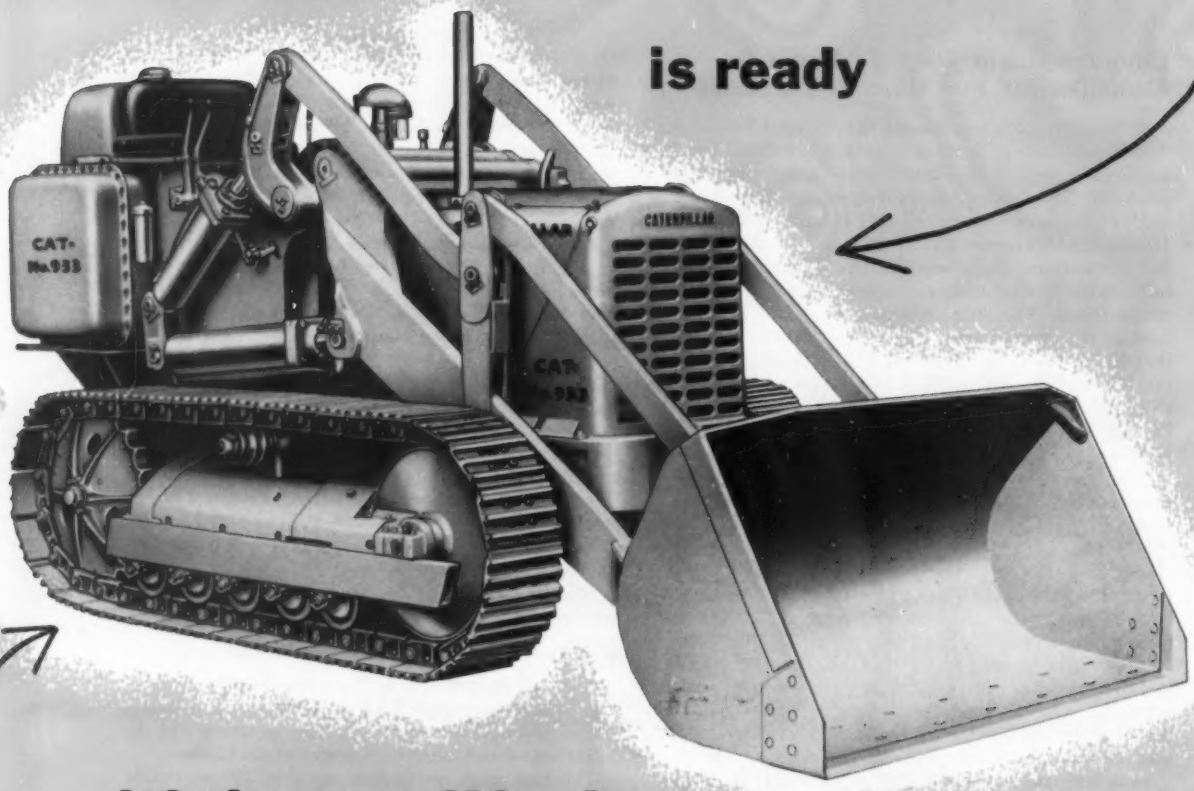

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For complete details on this *tough* new Traxcavator, call your Caterpillar Dealer. He'll be glad to give you full information on the complete line of Cat-built Traxcavators. He's the man to remember, too, for expert service and for replacement parts you can trust.

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and other accessible sources of usable grades of manganese.

"At present, however, government-held inventories of specification-grade metallurgical manganese are far in excess of minimum stockpile objective, and quantities on hand and on order are almost equal to the long-term objective. Thus we have on hand and on order sufficient specification-grade metallurgical manganese to meet any foreseeable national emergency.

"There is thus no immediate urgency to utilize the low-grade material now in government stocks and accruing under the domestic low-grade manganese support program. The material, of course, could serve as a reserve beyond the ample amounts of specification-grade material on hand and on order should unforeseen developments indicate a need for upgrading it to usable form.

"In view of the foregoing, it is concluded that defense justification cannot presently be established for the beneficiation program."

This seems to close the book on attempts to obtain government programs for upgrading the Wenden, Deming, and Butte manganese, at least for the time being. How a private company might fare with a proposal to buy the material may be another matter.

• SEC Proposal Brings Protests

Mining companies are up in arms over an amendment which the Securities and Exchange Commission is proposing to Form 10-K, the form used in annual reports to the SEC by corporations listed on national securities exchanges and by companies subject to SEC reporting requirements. The amendment takes the form of an added new instruction which reads as follows: "In the case of an extractive enterprise, furnish such material information as to production, reserves, location, development, and the nature of the registrant's interest as may be necessary to keep reasonably current the information previously reported in regard to such matters."

The proposal was described as "rank discrimination" against the extractive enterprises by requiring from them detailed information not required from other industries. Mine operators also stressed the point that estimates of remaining mineable ore reserves are always difficult and often impossible to make since they depend on many other factors than the physical conditions underground, such as the economics of the industry at the unknown future date of mining, and upon advancements in mining technique which may or may not occur. Because of the unreliability of such data, it was said, neither investors, stockholders, nor the general public would be benefited.

• Lead-Zinc Purchases Are To Continue

It has been known for some time that the 200,000 tons of lead and 300,000 tons of zinc, the amounts set for the program's additions to the maximum national stockpile quota, are nearly exhausted. In spite of the "benefits" of barter, domestic producers have been worried about the effect on the markets when the program ended. The last GSA call brought in an unusually large quantity, showing a surplus on the market. Gordon Gray, the new director of the Office of Defense Mobilization, has elected to continue the program although the amount of the increased tonnage has not been announced.

• Miners Call It A Dizzy Business

The government passed an act to protect the wool industry from Australian competition by means of a subsidy. Now, the Commodity Credit Corporation is trading 3,000,000 pounds of wool to Turkey for strategic materials, probably chrome. A pretty dizzy business, it seems to us.

• It Sounds Like An Endless Task

The Wormser formula for keeping the U. S. mining industry healthy is most intriguing. We barter our surplus agricultural products for copper, lead, zinc and other minerals and metals, and sew them up in the supplemental and national stockpiles. The idea seems to be that by locking up enough foreign minerals and metals we keep up world prices, leave less for private imports, and thus support domestic prices. This sounds like the endless labor of Sisyphus, the mythical king of Corinth, condemned in Hades to roll a heavy stone up a steep hill only to have it always roll down again when he approached the top!

• Congress Receives Idaho Resolution

The Idaho State Legislature, in House Joint Memorial 6, petitioned the Congress to do something to aid the strategic metal mining industry and also for copper, lead and zinc. In a speech asking that the Memorial be included in the Congressional Record, Senator Church remarked:

"For three long years the Congress has been waiting for a report and recommendations from the Department of the Interior in this matter, and during that period of time the Office of Minerals Mobilization, created for the announced purpose of drafting a long-range minerals program, has been costing the taxpayers some $300,000 a year, and the results have been nil. The time is at hand for this agency either to deliver the goods, or for Congress to abolish it.'

Did we hear an echo saying "Amen?"

• Liebert's Comment Arouses Speculation

During hearings before the Senate Appropriations Committee on the urgent deficiency appropriation of $30,000,000 for implementing Public Law 733, the mineral purchase act, there was an interesting exchange between Senator Dworshak and John Liebert, who was testifying for the Department of the Interior in favor of the appropriation.

Senator Dworshak asked Liebert: "Do you want continuance of this interim program?" To which question Liebert replied:

"No, not beyond the extent of the current legislation. Personally, I cannot speak for the Administration, you understand, Sir, but I think it is time for *the Congress* (emphasis supplied) to come up with a total program affecting the total minerals industries of the United States."

What made this comment so intriguing is that the Congress has been waiting for some years for the Interior Department and the Administration to present to it a comprehensive program which can be resolved into legislation. It would seem that Liebert either does not think that such a recommendation will be forthcoming, or that it will be so unsatisfactory that the Congress should draft a policy and legislation of its own immediately and not wait for the government's long-range minerals program to be presented.

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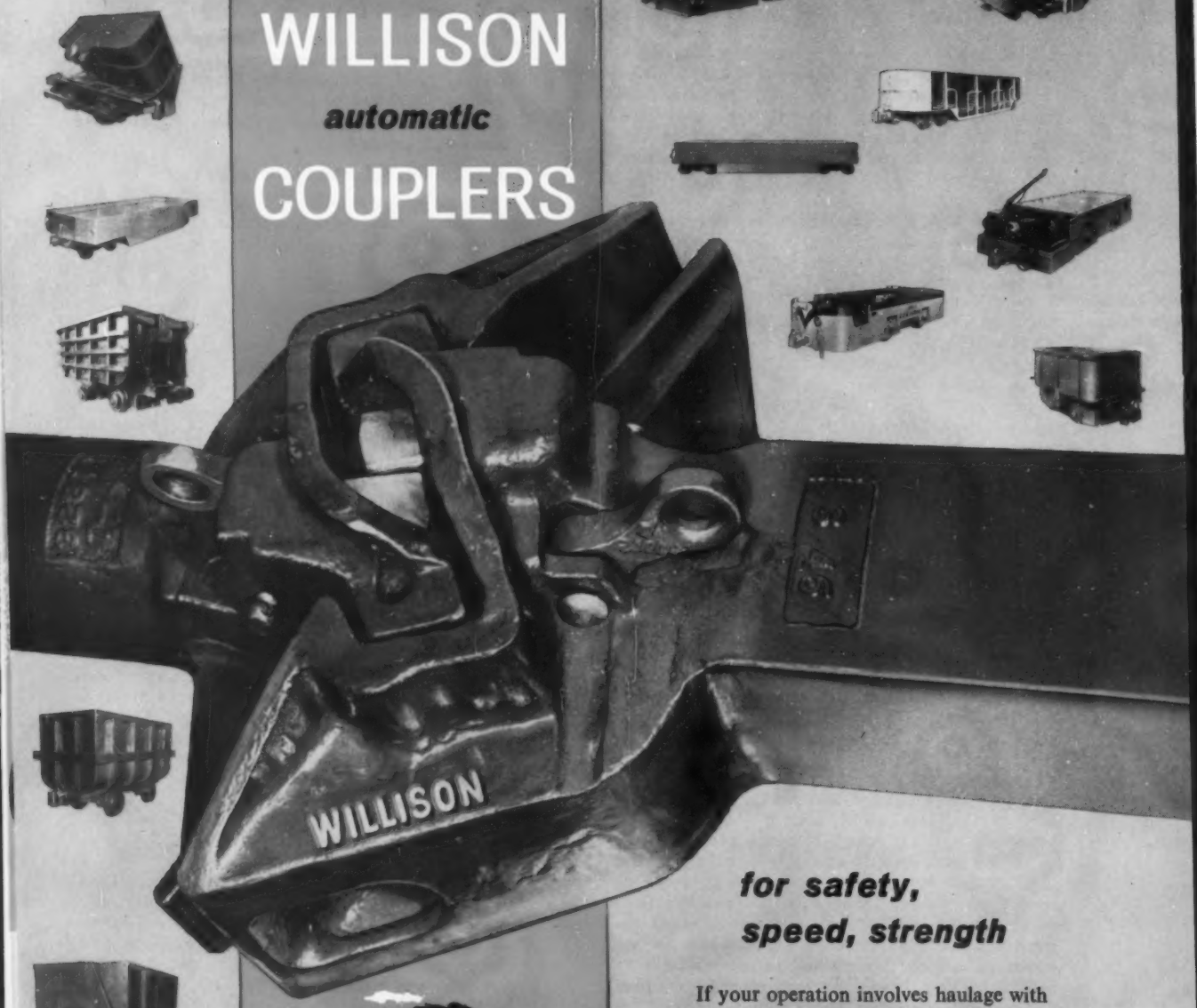

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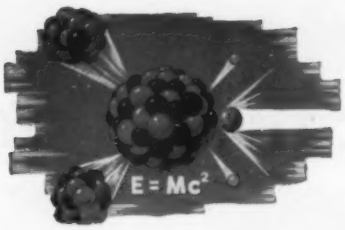


FISSION FACTS

Monthly Roundup of Mining News
In the Atomic Energy Field

Three Mills Approved for Ambrosia U_3O_8; Two For Homestake, and Largest in USA for Kermac

United States Atomic Energy Commission contracts have been signed for two new large uranium mills, bringing to three the number which will treat ores from Ambrosia Lake, New Mexico. The AEC has agreed to purchase concentrates from the 1,500-ton-per-day mill of Homestake-Sapine Partners, and the 3,300-ton-per-day mill of Kermac Nuclear Fuels Corporation. The latter will be the largest single mill ever built in the United States to treat uranium ores.

The Homestake-Sapin project will be the second mill for Homestake in the Ambrosia area. Homestake's first mill, and incidentally, the first for Ambrosia ores, is being built for Homestake-New Mexico Partners and will have a capacity of 750 daily tons. Both of Homestake's mills are located northwest of Grants and south of Ambrosia, necessitating trucking of the ore from the mines.

The Homestake-Sapin Partners is a limited partnership with Homestake furnishing the financing, management and operation staffs; developing the mine; and stockpiling ores. Sapin Partners (Sabre Uranium Corporation and Pinon Uranium Company, Inc.) is contributing more than 5,000,000 tons of proven ore, probably grade 0.26 percent U_3O_8, in sections 15, 23, and 25, T. 14 N., R. 10 W., to the partnership. Sapin will receive 25 percent of the net mill receipts under the partnership. Mineral rights for 30 additional sections in the area were retained by Sapin. These are the same sections that Sapin had under option to the American Metal Company in 1956. Under this option a stock exchange and purchase would have given American Metals control of the companies and American would have developed the mine, negotiated a milling contract, built a mill, and managed the operations until December 31, 1956. However, American Metals never consummated the contract and withdrew completely from the area.

Kermac's mill will be built in Ambrosia Lake, probably in Section 22, T. 14 N., R. 10 W. McKinley County, where the largest ore body is located. Kermac has drilled a large deep well to secure necessary water. This site has a further advantage in that sand tailing can be used for stope fill. However, no housing for employees is presently available at the mine-mill site.

Kermac Nuclear Fuels was organized in July 1956 by Kerr-McGee Oil Industries, Inc., Oklahoma City, Oklahoma; Anderson Development Corporation, Albuquerque, New Mexico; and Pacific Uranium Mines Company, Los Angeles, California. Controlling interest (56 percent) is held by Kerr-McGee, which completed its first uranium concentrator at Shiprock, New Mexico, in December 1954, and has been conducting a vigorous metallurgical research program with emphasis on uranium. Kerr-McGee will staff and operate the new mine and mill under a concentrates purchase contract which "will run through December 31, 1966."

Anderson Development Corporation has been carrying on an extensive exploration and development program during the past 24 months on its leased property in the Ambrosia Lake area. Pacific Uranium Mines Company entered the uranium business in 1953, launching a program of exploration in the Colorado Plateau, beginning in 1955, with emphasis on potentially productive areas in New Mexico.

Kerr-McGee and United Western Minerals have mineral rights to Section 22, T. 14 N., R. 10 W. where the largest ore bodies have been drilled out. Kerr-McGee also has rights to Section 10 where a shaft has recently been completed. Pacific Uranium has rights to north ½ of Section 12, and all of sections 24, 26, and 27. Anderson's rights are in Section 12, and all of sections 18 and 30 of T. 10 N., R. 9 W.

Exploration drilling on these properties has developed 15,000,000 tons of proven ore, 10,000,000 tons of probable ore, and 7,000,000 tons of potential ore. Ore bodies appear to be very irregular, sinuous, and pinch out completely in places. However, in the heart of the district, ore in Kermac's Section 22 and Sapin's sections 23 and 25 appears to be almost continuous over a width of one mile. Ore thicknesses vary from less than one foot to more than 100. Kermac has used 4.0 feet of 0.10 percent U_3O_8 ore as a cut off in calculating proven reserves which average 0.32 percent.

Kermac has spent more than $2,000,000 in exploration drilling to develop these reserves. More than 2,500 holes to depths from 300 to 1,200 feet were drilled for a total footage of 1,600,000.

The largest mine will be located on Section 22, T. 14 N., R. 10 W. where Kermac will build a surface plant, sink a shaft to depth of about 900 feet, and develop a mine at a minimum cost of $1,125,000.

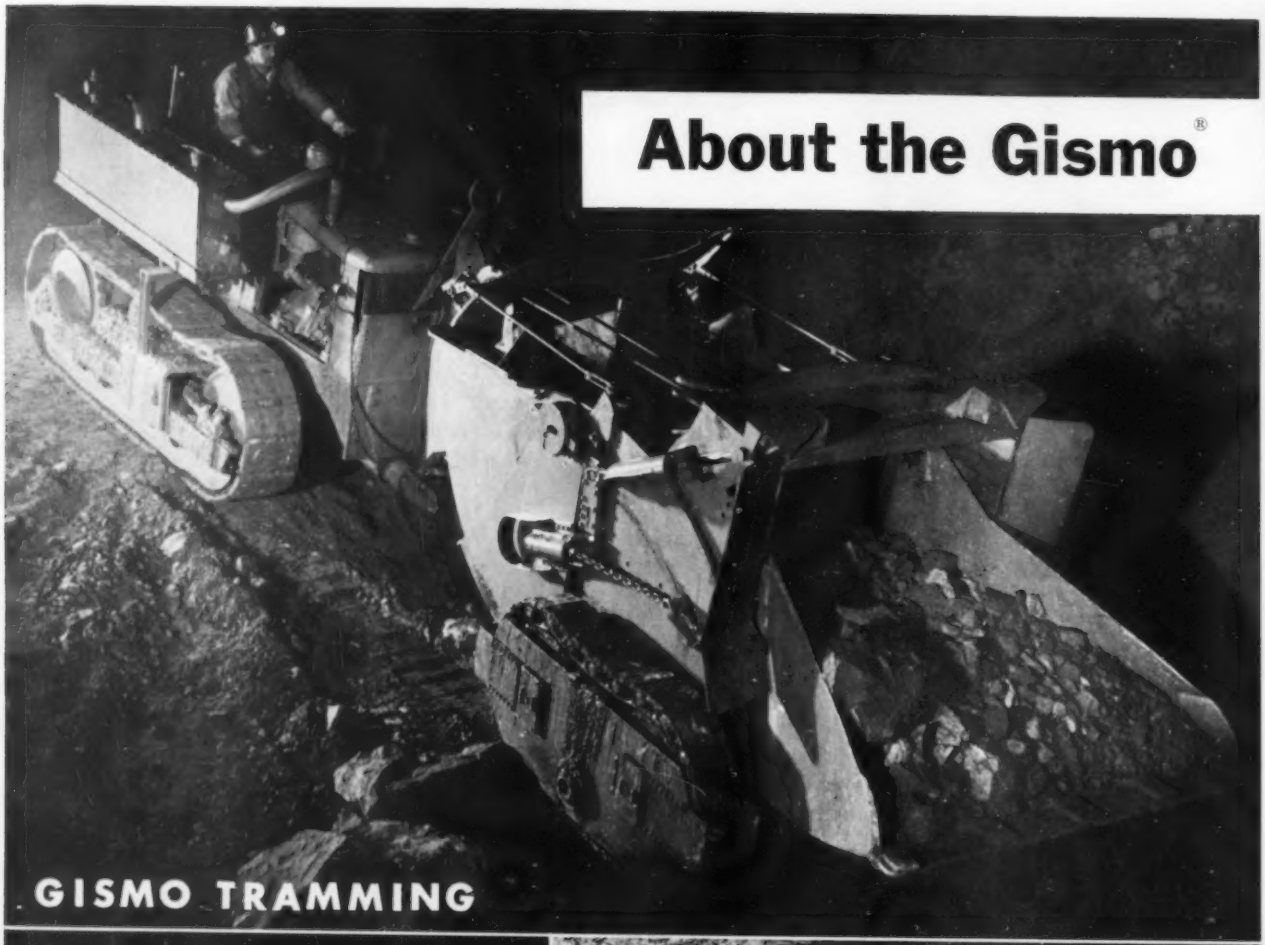
The three mills now building will treat company ore primarily but custom ores will be accepted under terms of the AEC contracts. However, additional mill capacity is needed to treat all ores currently developed. Phillips Petroleum Company has drilled out several millions of tons of ore in section 21 and 34, T. 14 N., R. 9 W. and is negotiating with the AEC for a concentrate purchase contract for a 1,500-daily-ton mill. Phillips is currently one of the most aggressive exploration companies in the area and has entered into several drilling agreements with other companies that hold mining rights. Phillips is definitely expansion mined in uranium and has the cash to carry out a long-range program.

Very substantial reserves have been developed and are being extended in the southeast section of Ambrosia by Calumet and Hecla, Inc., and United Western Mineral-Four Corners Exploration Company in sections 23 and 14, T. 13 N., R. 9 W. No announcement has been made as to where this ore will be milled. Calumet and Hecla is currently sinking a shaft to develop its ore body.

Much exploration activity and deep, to 2,000 feet, drilling continues east, northeast, and southeast of Ambrosia. However, the area to watch is to the west. It would not be surprising if another very important ore body be developed there by drilling.

KERMAC'S using six drill rigs to develop millions of tons of ore on Section 22, T. 14 N., R. 10 W. in the heart of Ambrosia Lake. The new 3,300-daily-ton mill will be built in this area. Haystack Butte, where first uranium ore in the area was found in 1951, looms on the far horizon.

About the Gismo®



GISMO TRAMMING

LOADING

DRILLING

DUMPING / IN PRODUCTION

DUMPING / IN S-D CARS IN DEVELOPMENT

equipment– what are the facts?

Unquestionably, tomorrow's production economies and records in profitable mining operations will be the direct result of management's selection of proper equipment . . . equipment around which a simple production method can be devised. And certainly the major prerequisite to maximum simplicity is *minimum equipment, minimum labor with maximum production of both.* A plan conceived and organized by management around the criterion simplicity becomes increasingly efficient.

We believe the use of the Gismo equipment offers management the logical opportunity of devising a simple production plan. Quite successful systems organized and built around the Gismo have not only resulted in great economy in use of labor and equipment, but have practically eliminated deficiencies of time cycling operation.

Three men with one Gismo Self-Loading Transport, one Gismo equipped as a 4-drill stoping jumbo and a Gismo tractor have produced over a long period of time in excess of 400 tons per shift. Much less stoping space was required by the Gismo method. The simplicity of the operation together with the greatly reduced manpower made it possible for supervision to practically eliminate the problem of close co-ordination and time cycling between the various departments of the mine such as drilling, blasting, loading, transporting, hoisting and general services.

We realize producing such tonnage for so few dollars is a tremendous step forward. The natural reaction is to believe you are reading fantastic figures and statements. Nevertheless, all these facts are very true and they could mean but one thing. With the use of the Gismo equipment you are now free to organize the simple production method you have always strived for but have not been allowed to obtain because equipment permitting simple systems to function has not been available until now. *Sanford-Day Iron Works, Inc., Knoxville, Tennessee, USA*

We believe it is vital for mining management to become informed on how the Gismo equipment would fit into their operation. The advantages of this tremendous step forward have resulted in some companies abandoning well set plans to purchase other types of equipment in favor of investing in the Gismo. They found upon investigation, as we believe you, too, will find, that the economies offered by the Gismo equipment and the simple method of mining it enables you to organize are far greater—entirely too great to temporarily pass off simply as a new type of equipment. In fact, so great are its potential economies that this equipment could easily mean in but a few years the difference between profit or loss.

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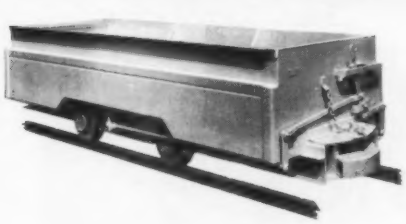

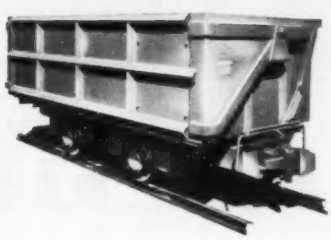

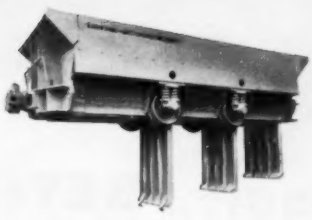

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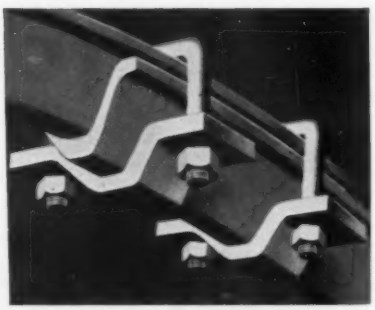
It's just good economics to use Bethlehem Yieldable Arches

When mine roof support becomes a real problem, Bethlehem's Yieldable Arch sets can do an efficient job, and an amazingly economical one.

It's the "give" in the Yieldable Arch that does the trick. An individual arch is made up of segmental sections which nest into one another at the ends to form an overlapping joint. The joint is secured by U-bolt clamps drawn up tight enough to hold fast under normal loads. Struts are installed between arches to provide lateral stability.

When pressures become excessive, the joints yield and permit the overburden to settle slowly and form its own pressure arch. Thus safety in the



mine is maintained, mining operations can continue, and maintenance costs are reduced.

When the arch sets have served their purpose at one point, they can be salvaged and re-used elsewhere. And Yieldable Arches far outlast timber supports. One mine recently estimated that their Bethlehem arch sets paid for themselves within six months!

If you are interested in talking about the Yieldable Arch or if you would like to learn how it is performing for others, a Bethlehem Pacific engineer will be glad to meet with you at your convenience. You can reach him through our nearest sales office.

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The Right Pick is important. That applies to choice of trailing cords and cables, too. Be guided by the fact that veteran mine-men prefer TIREX. This expertly engineered cable, newly improved for greater flexibility, has cured-in-lead Neoprene Armor that resists abrasion, oil, heat and water . . . gives maximum wear.

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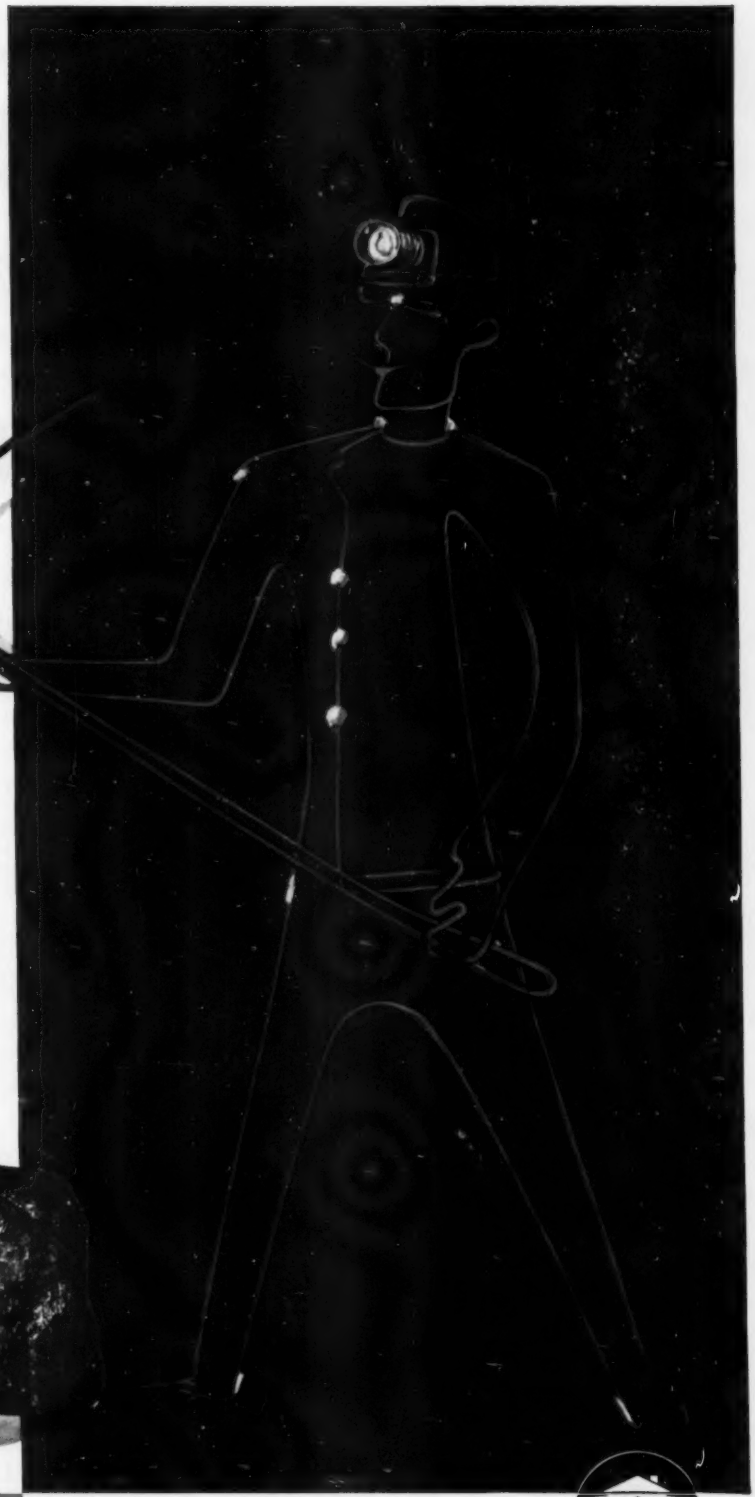

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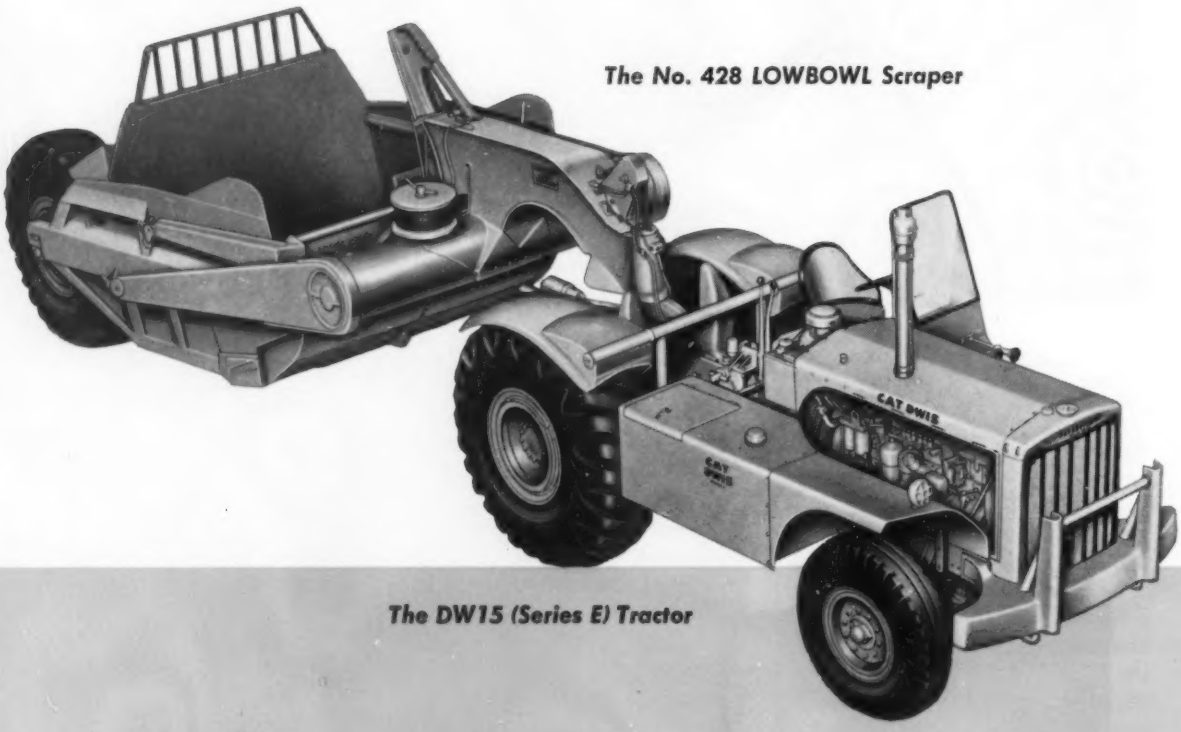
CATERPILLAR ANNOUNCES

NEW DW15 (SERIES E) AND NEW No. 428 LOWBOWL SCRAPER



The No. 428 LOWBOWL Scraper

The DW15 (Series E) Tractor

Here's a new Cat team loaded with features that add up to one thing—A HIGHER PRODUCTION RETURN ON YOUR INVESTMENT. See your Caterpillar Dealer for details on this great team's performance.

GET THE STORY IN BRIEF ON THE OPPOSITE PAGE ▶

A GREAT TEAM: The performance of the DW15 (Series E) Tractor and No. 428 Scraper can be summed up simply: bigger loads—faster.

FACTS ABOUT THE DW15 (SERIES E) TRACTOR

Around the world, the DW15 has proved that it can move material faster and more profitably than competitive machines in its class. Now there's a new DW15 (Series E) to give you even higher production. This is the story:

ENGINE: A new Caterpillar D326 Engine, designed especially for the DW15 (Series E), develops 200 HP (maximum output capacity).

And Caterpillar research has produced a 23% torque rise in this new engine! This means that high tractor rimpull is maintained through a wide range of travel speeds in each gear, and the need for gear changing is decreased. In fourth gear, for example, over 3,000 pounds of rimpull are delivered at travel speeds from 9 MPH all the way to 18 MPH. A new engine, yes—but with these traditional Caterpillar advantages: uses inexpensive No. 2 furnace oil without fouling; needs no fuel system adjustments; requires no cleaning of fuel injection valves.

TRAVEL SPEED: The DW15 (Series E) offers ten speed selections, from 2.7 to 37.2 MPH. But, more important, it provides four-wheeled sure-footedness—*the ability to use the speed on the job.* Operators ride with more comfort, feel greater stability. They travel faster, and in safety.

MANEUVERABILITY: Four-wheeled stability means faster cycle time because the DW15 (Series E) can make short radius turns at higher speeds. It can turn without stopping inside a 35-foot diameter and in a smaller area through use of a turn-back-turn maneuver.

VERSATILITY: The DW15 (Series E) provides versatility that far surpasses similar sized two-wheeled machines. It can be unhitched from its scraper and used as an independent unit to tow compactors, water wagons or other units, and it can be teamed with the Athey PR15 Wagon for rock hauling work.

FACTS ABOUT THE No. 428 LOWBOWL SCRAPER

CAPACITY: Struck—13 cu. yd.; heaped—18 cu. yd.

ADVANCED DESIGN: There is more to Caterpillar's exclusive LOWBOWL design than a low bowl profile. Width and length proportions are designed to give maximum loading efficiency. And every component—particularly the apron, ejector, cutting edge—is likewise designed to do its part in achieving capacity loads.

LOADABILITY: The final result of this careful engineering is this: bigger loads—faster. LOWBOWL design gives the new Caterpillar No. 428 Scraper a faster loading rate because incoming material meets less material resistance and less friction from the load already in the bowl. While other scrapers are still in the cut struggling for the last few yards of their load, the new Cat units are on their way to the fill—with big pay loads!

NEW FEATURES: Outstanding new features of the No. 428 include: increased ground clearance—for high-speed travel in rough going; increased apron lift—for faster ejection of any material; large area pushblock—for better pusher contact.

NEW TIRES FOR THE DW15-No. 428

Both the CAT* DW15 (Series E) Tractor and No. 428 Scraper feature 26.5-25 wide-section tubeless tires—the product of extensive co-operative research by Caterpillar Tractor Co. and leading tire manufacturers. Tubeless tires offer load-carrying capacity comparable to conventional tires at a *reduced inflation pressure.* This gives better flotation and traction while decreasing rolling resistance. The wider tire treads take a "grouser like" bite, making more efficient use of engine horsepower. And tubeless tires eliminate 80% of the down time caused by tire failure.

Caterpillar Tractor Co., San Francisco, Cal.; Peoria, Ill., U.S.A.

CATERPILLAR*

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ONE GOAL: To concentrate our capabilities, resources and experience on the design, manufacture, distribution and service of job-tested heavy equipment.

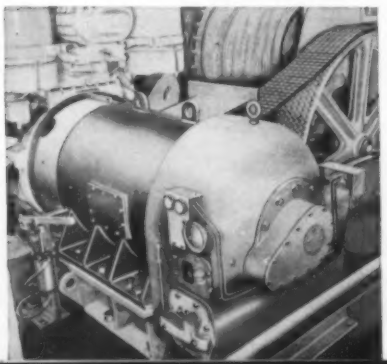
LIMA Type 2400 with Torque Converter moves overburden faster at lower cost

The torque converter, standard equipment on all LIMA Type 2400 machines, is another of the quality features that enable LIMAS to outperform and outlast ordinary machines. It automatically increases torque as required by the load, making higher output possible by avoiding stalling and making performance much smoother and faster.

For assignments calling for an electrically-powered 6-yard machine, the LIMA Type 2400 is available with complete electrical power package. Combining a single AC electric motor with a single stage torque converter, this drive matches, *electrically,* diesel-torque converter performance. You get maximum power performance under all operating conditions . . . and the motor won't stall or burn out.

Cable life is increased and machinery maintenance reduced because shock loading is minimized as the oil in the converter cushions any sudden blow. Friction clutches last much longer because the torque converter reduces friction clutch slippage during acceleration.

LIMA quality design and construction extras make for profitable, efficient operations with minimum downtime. There's a LIMA type and size for every job—shovels ½ to 6 cu. yds., cranes to 110 tons and draglines variable. Smaller capacities are available on rubber. For full details, contact your nearby LIMA distributor, or write Construction Equipment Division, Baldwin-Lima-Hamilton Corporation, Lima, Ohio.



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New Timken® bit for air-leg drills and light stoping . . .

NEW TAPERED SOCKET
gives more secure union

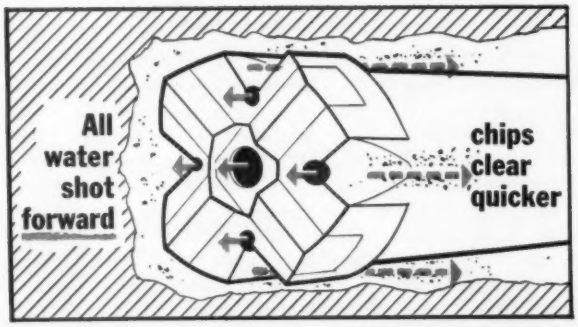
NEW FRONTAL DESIGN
speeds chip removal

You can lower your cost per foot-of-hole with this new Timken® tapered socket bit. With its uniformly tapered socket, the new Timken bit gives a more secure union for feed-leg drills. The precision-made taper fits tight to the drill steel, reduces breakage.

And the bit is removable, lets you make quick, easy bit changes. You drill out full steel life.

The new frontal design, with its specially positioned five front holes and deeper, wider wing clearance, speeds chip removal. Drilling goes faster, costs are cut even more.

Special analysis carbides give superior wear-resistance with added shock-resistance. And the new Timken tapered socket bit can be reconditioned many times to give you more feet-per-bit. Comes in 3 popular sizes: 1¼", 1⅜" and 1½". The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".



How New Frontal Design Speeds Chip Removal. The new five front holes direct air or water with jet-action velocity against face—wash away chips faster. Deeper, wider clearance between cutting wings works in unison with five front holes to give speedier removal of Rock Cuttings. Tests show these new features speed drilling, lower your cost per foot-of-hole.

TIMKEN MULTI-USE BIT (left) with correct, controlled reconditioning gives lowest cost per foot-of-hole when full increments of steel are used. **NEW TIMKEN THREADED CARBIDE BIT** (right) for other tough jobs. Improved thread contact reduces breakage. New wear-resistant carbides add life.

TIMKEN ***REMOVABLE ROCK BITS***

TRADE-MARK REG. U. S. PAT. OFF.

New Forward Control Design provides more space because the engine is behind you. It puts a 74" pickup box on 81" wheelbase—record-breaking cargo space per inch of wheelbase. This efficient design makes maneuvering through rough terrain faster and safer.

How the New Forward Control 'Jeep' FC-150 speeds your tough mining jobs!

All-Wheel Traction. With the extra traction of its 4-wheel drive, the FC-150 travels through mud, sand, soft earth, and climbs hills as steep as 65%... in good weather or bad. Yet, it shifts easily into 2-wheel drive for highway travel at top legal speeds.

On job after job, the all-new Forward Control 'Jeep' FC-150 keeps mining jobs on schedule with savings of time and manpower. That's because it's made to order for every phase of mining operations.

Here's a 4-wheel drive truck that gives you maximum cargo space on minimum wheelbase. It maneuvers through the heavy, rough going of mining projects, with crew and equipment, where ordinary trucks call it quits. Riding comfort!—you have to test drive it to believe it! There's plenty of head, leg, and shoulder room! The all-new Safety-View cab lets you see terrain as close as 6 feet from the front bumper. It combines with the new wrap-around windshield—largest in the FC-150 weight class—for up to 200% greater forward visibility. With power take-off, the FC-150 operates a variety of special equipment from winches to portable drills.

The new 'Jeep' FC-150, G.V.W. 5,000 lbs., is powered by the economical engine that made 'Jeep' vehicles famous. It combines with a new 16-gallon gas tank to let you cruise up to 300 miles on *one* filling. See your 'Jeep' dealer for a demonstration!

There's a 4-Wheel-Drive 'Jeep' vehicle for your job!

Universal 'Jeep'

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WILLYS... world's largest makers of 4-Wheel-Drive vehicles

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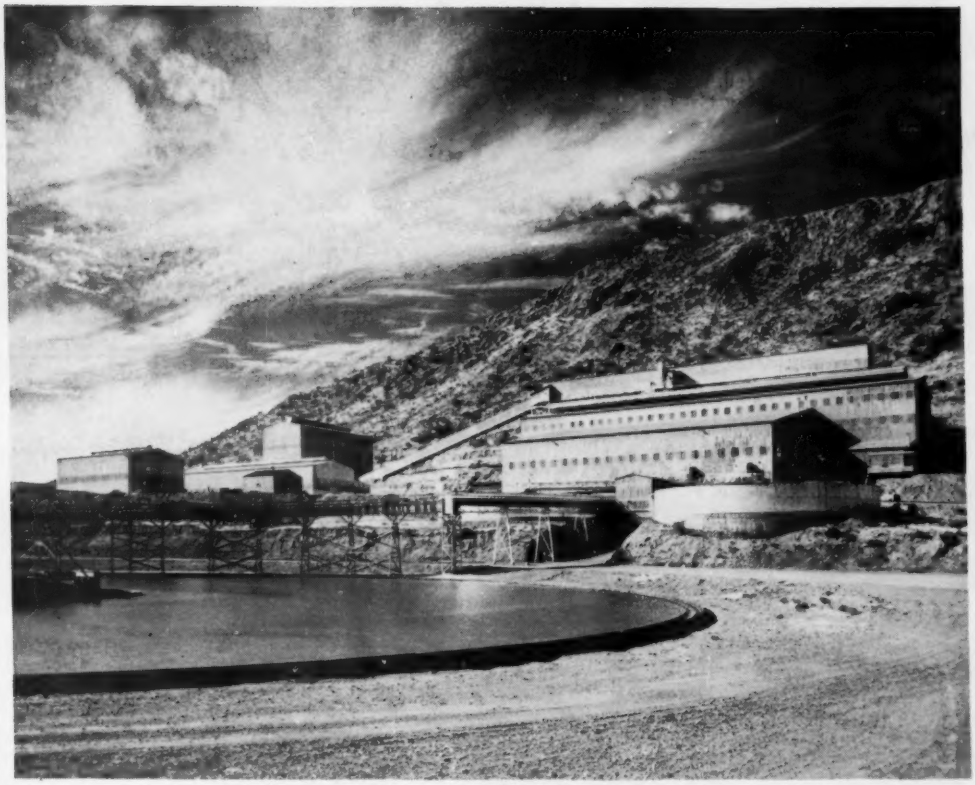

"Modern Copper Concentrator at Silver Bell, Ariz., for American Smelting & Refining Company"

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Planning for successful operation begins with preliminary designs and cost estimates. From start to production, assign Stearns-Roger the task—one order, one responsibility for design, engineering, procurement and construction. For new plant or modification,

TAKE IT UP WITH...

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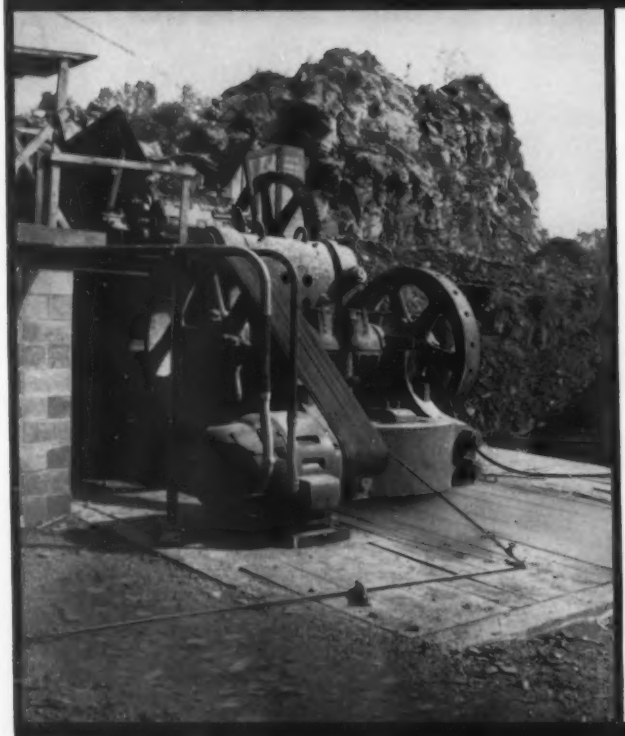
the expert fisherman
has his rod custom-made
because he gets
something **EXTRA**



the profit-wise operator

BUYS TRAYLOR JAW CRUSHERS for the same reason

For over half a century, producers have specified Traylor-made Jaw Crushers to insure extra hourly production with lower operating costs per ton. There are four types of Traylor-made Jaw Crushers to fit every primary breaking requirement. Feed openings range from 8″ x 12″ to 60″ x 84″; capacities from 4 to 1000 tons per hour. For bulletin on Traylor Jaw Crusher suited to your needs, write stating product size and capacity desired.

TRAYLOR ENGINEERING & MFG. CO.
962 MILL ST., ALLENTOWN, PA.
Sales Offices: New York—Chicago—San Francisco
Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P.Q.

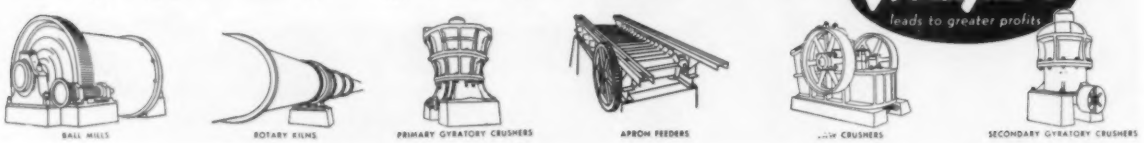
9

the experts agree . . . there's nothing like

TRAYLOR-MADE

equipment for peak performance

A Traylor leads to greater profits



This Allis-Chalmers 197-hp diesel "matches the needs" for tough excavator service in the Bucyrus-Erie 2½-yd 54-B.

ALLIS-CHALMERS ENGINES MATCH YOUR NEEDS

MATCH YOUR PERFORMANCE STANDARDS — with Allis-Chalmers high-torque, high-usable-horsepower engines that *stay on the job.*

MATCH YOUR POWER REQUIREMENTS — from a wide range of sizes and types, 9 to 516 hp. Specify or install them in *all* your equipment.

MATCH YOUR FUEL SITUATION — There are Allis-Chalmers engines for any fuel you choose — diesel, LP gas, natural gas, or gasoline.

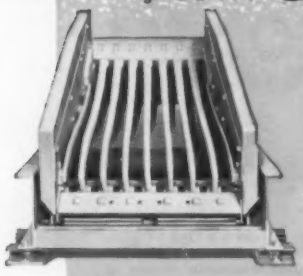
MATCH YOUR SERVICE NEEDS — with close, fast parts and service, wherever you are. Your Allis-Chalmers engine dealer has a full stock of parts, factory-trained servicemen and complete facilities to give you prompt service in his shop or on your job.

See your Allis-Chalmers dealer for full information on engine power and service matched to your needs. Allis-Chalmers, Buda Division, Milwaukee 1, Wisconsin.

BC-8 A

ALLIS-CHALMERS *Engineering in Action*

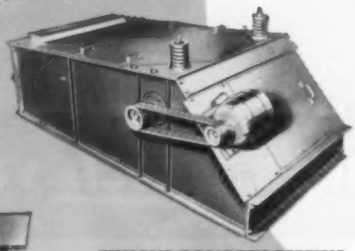
From Scalping to Fine Screening . . .



SYMONS VIBRATING BAR GRIZZLIES for heavy duty large capacity primary scalping where clear spacings of 1½" and larger are permissible. Up to 500 tph, handling feeds ranging to 30" and larger.

SYMONS® SCREENS meet production demands for the MINING INDUSTRY

SYMONS VIBRATING ROD GRIZZLIES for heavy duty big capacity scalping. Up to 500 tph for feeds up to 12". Ideal for scalping operations requiring relatively coarse separations in the range between 1" to 4".



SYMONS ROD DECK SCREENS employ a highly efficient screen deck utilizing individual replaceable steel rods. Features low screening cost — big capacity — long life — ideal for moist and sticky materials.

SYMONS V-SCREENS give unequalled high capacity for sharp, single cut, wet or dry separations, especially in the finer sizes. This high capacity, sharp separation is the result of centrifugal force—an exclusive Symons V-Screen feature.

Symons Vibrating Grizzlies and Screens are playing an increasingly important role in the efficient processing required in producing big tonnages of ores and minerals. From heavy duty scalping operations on through fine screening, more and more leading producers are depending upon Symons screens to do a better separation job at lower cost per ton.

These quality grizzlies and screens have gained an enviable reputation for dependability and efficiency throughout the mining industry . . . and are backed by the same high standards of accuracy, workmanship and progressive engineering that is used in the manufacture of *all* Nordberg Machinery.

Mail the coupon for further details.

SYMONS . . .
A REGISTERED NORDBERG TRADEMARK KNOWN THROUGHOUT THE WORLD.

Mail this Coupon Today!

NORDBERG MFG. CO., Milwaukee, Wisconsin

NORDBERG MACHINERY **NORDBERG**

SYMONS SCREENS NORDBERG

MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

NEW YORK • SAN FRANCISCO • ST. LOUIS • DULUTH • WASHINGTON
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Nordberg Mfg. Co., Milwaukee, Wisc.

Send literature on SYMONS: ☐ Bar Grizzlies; ☐ Rod Grizzlies; ☐ Rod Deck Screens; ☐ V-Screens

Name_____

Company_____

Address_____

City_____ Zone____ State_____

S456

© 1956, Nordberg Mfg. Co.

How to boost pit output... cut handling costs

Short turn radius of Rear-Dumps allows quick spotting in restricted areas. Low rear-entry and wide bowl provide easy target for shovel operator . . . make for fast dipper swing-out, let shovel operator heap maximum yardage without spillage.

The use of modern LeTourneau-Westinghouse Tournapull Rear-Dumps on your pit hauls can cut cycle time, boost production, and lower operating costs. Here's how:

Greater maneuverability — Positive electric power steer, through geared kingpin, permits prime-mover to pivot at right angles for short 90° turns. As a result, unit makes continuous U-turn in less space than Rear-Dump's own length. In dump position, it turns in only about ⅔ of overall length!

There's no need for turntables or elaborate turn-around areas. You spot faster at the shovel, dump faster, and get away faster from pit or dump. On the haul, you make hairpin turns with safety — complete cycles faster. Time saved adds up to extra trips per shift, greater production . . . with no increase in manpower or equipment investment.

Speeds loading — Low, wide bowl permits shovel bucket to swing in low for faster loading. It permits quick bucket swing-out, even while dipper-door is still open. And because of large target area, spillage is greatly reduced. Production delay during the day for clean-up of pit floor is minimized.

Dumps fast, clean — Flick of switch on control panel instantly activates point-of-action electric-hoist motor. Body raises quickly, to desired angle. At full dump position, edge of bowl is low behind rear wheels . . . material cannot roll forward to lodge against wheels, nor pile under rear end. Streamlined body sheds stickiest material readily.

Resists body shock, damage — Shovel operator does not have to take it slow and easy when loading. Rear-Dump body is ruggedly built. Simplicity of Tournapull Rear-Dump construction permits using steel otherwise used in frame and sub-frame. In L-W Rear-Dumps this material is used to build greater strength into the bowl itself. Body is all steel — no wood fillers. Floor is lined with heat-treated tool-steel strips, welded to solid billets laid over heavy steel plate.

Ask for complete information

If you're interested in increased production and lower handling costs, it will pay you to investigate high-production Tournapull Rear-Dumps. 3 sizes: 11, 22, and 35 tons. Write for full specifications.

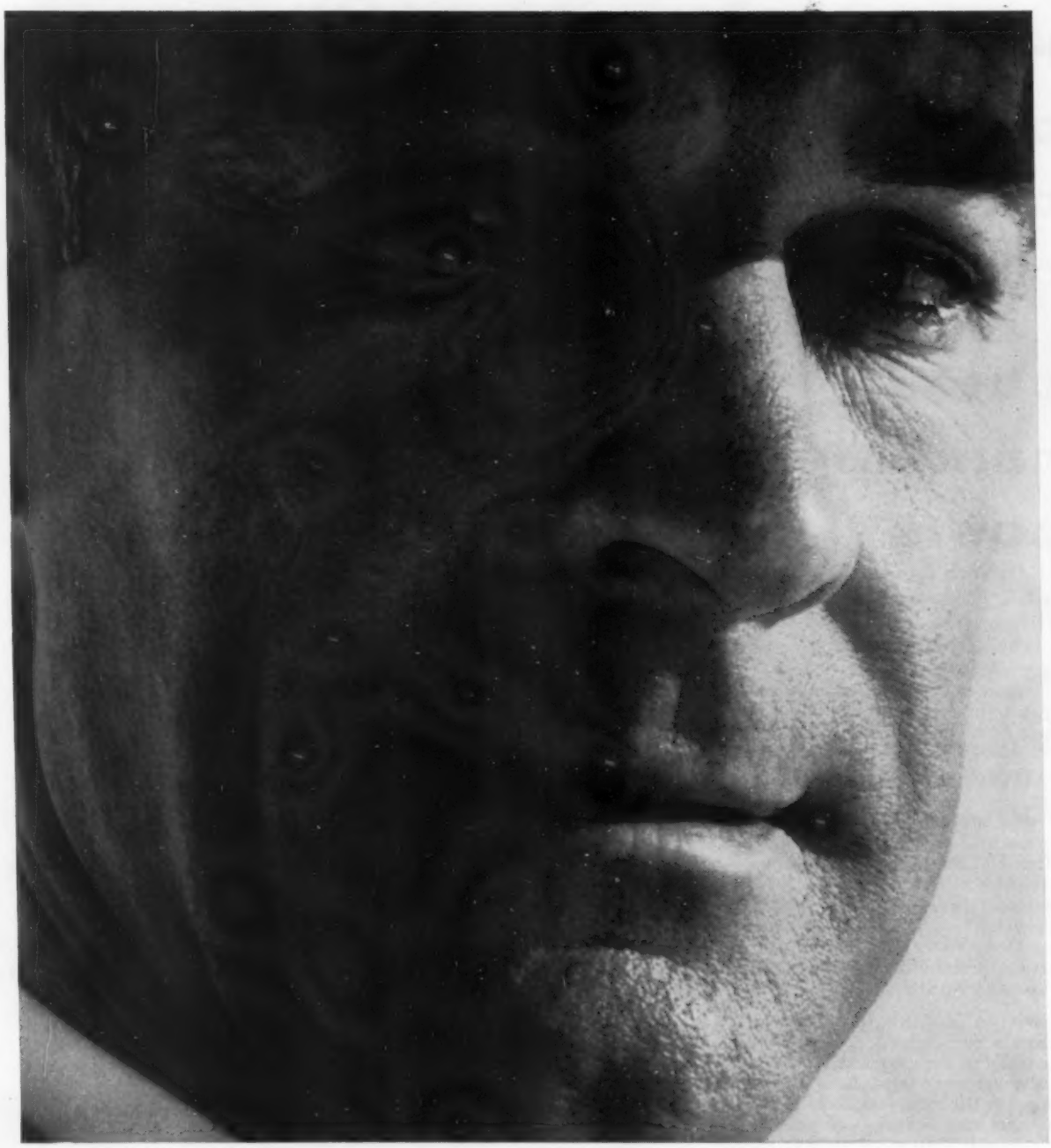
Tournapull—Trademark Reg. U.S. Pat. Off. R-1452-M-1

Big single, low-pressure tires . . . exclusive power-transfer differential . . . and 90° electric wagon-type power steer enables Rear-Dump to safely and steadily haul through muck, rock, and soft fill.

LeTourneau-WESTINGHOUSE Company, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit



When your process calls for chemicals talk to the man from Dow

YOU CAN DEPEND ON DOW FOR: XANTHATES • DOWFROTH® 250 • Z®-200 • SEPARAN 2610® • HYDROCHLORIC ACID • AMMONIA • CHLORINE CAUSTIC SODA • VERSENE® • MAGNESIUM OXIDE • MAGNESIUM HYDROXIDE • ION EXCHANGE RESINS • SOLVENT EXTRACTANTS

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

DOW

TOURNATRACTOR is a 208 hp tractor that *runs* on rubber instead of *crawling* on tracks.

Since its *introduction in 1946,* this electric-controlled tractor has been used successfully in every kind of climate, terrain, material, and on every type of tractor application, all around the world, by *thousands of owners.*

Their *job records prove* that Tournatractors can outwork crawler-tractors by as much as 2 to 1 where job conditions allow the use of its higher speeds.

Remember, too, that for this extra speed and greater production capacity, plus all the other "bonus" Tournatractor advantages described below, *you invest no more,* and *pay less for operation and maintenance,* than for any crawler-tractor of similar power.

Does speed fit your job?

Check these advantages for your mine!

Speed on the job...
Tournatractor pulls, dozes, pushes at speeds 2 to 3 times faster than any crawler. You change gears instantly, waste no time shifting, go up to 8 mph in reverse.

Mobility between jobs...
Tournatractor travels job-to-job at high rubber-tired speeds. Big, low-pressure tires drive anywhere—you need no planking or trailers—have no loading or unloading delays.

Lower maintenance...
Lubrication takes only a few minutes a shift on Tournatractor as compared to 15 minutes or more on a crawler. No cleaning of tracks, grousers, and other fittings.

Fewer repairs...
A set of tires or tracks costs about the same. But tires last 2 to 3 times longer than tracks under most conditions . . . without the usual maintenance expenses.

Ample flotation, traction...
Each tire grips area approximately 2 feet wide. Lugs bite deep to give plenty of traction. Low-pressures increase flotation, absorb shocks, aid compaction.

Less loss of power...
208 hp diesel drives through dirt-sealed anti-friction bearings to free-rolling wheels. All gears and bearings automatically lubricated . . . all parts easily accessible.

Shifts instantly...
Constant-mesh transmission eliminates delays in changing gears . . . saves vital momentum . . . gives you any gear ratio instantly.

Torque converter available...
This simple, dependable, low-pressure system provides the equivalent of an infinite number of gear ratios automatically selected to best balance load and torque.

Easier to operate...
Less jolt and jar reduces stress and strain on both operator and machine. Fingertip electric controls let operator work faster, with less end-of-shift fatigue.

Improves safety...
Low center of gravity, all-around visibility, quick response of controls make Tournatractor exceptionally safe to operate. Multi-disc air brakes have more than *4 times* the braking surface of most big tractors and trucks.

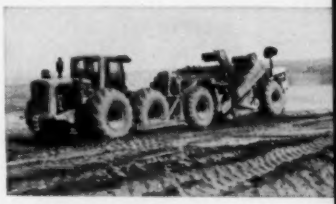
Interchangeable equipment...
Bulldozer, Angledozer, Root Rake, Snow Plow—all interchangeable—may be mounted on Tournatractor. Tilt mechanism and down-pressure attachment also available.

Easy to keep busy...
Stripping overburden, pushing scrapers, cleaning up around shovels, or handling a wide variety of utility jobs around the pit, Tournatractor's speed and power will save you time and money.

Ask your LeTourneau-Westinghouse Distributor to help you analyze specific Tournatractor applications on your work. No obligation!

Tournatractor—Trademark Reg. U.S. Pat. Off. T-733-M-b

Tournatractor pulls Carryall-Scrapers twice as fast as crawler-tractors. Hauls more in less time.



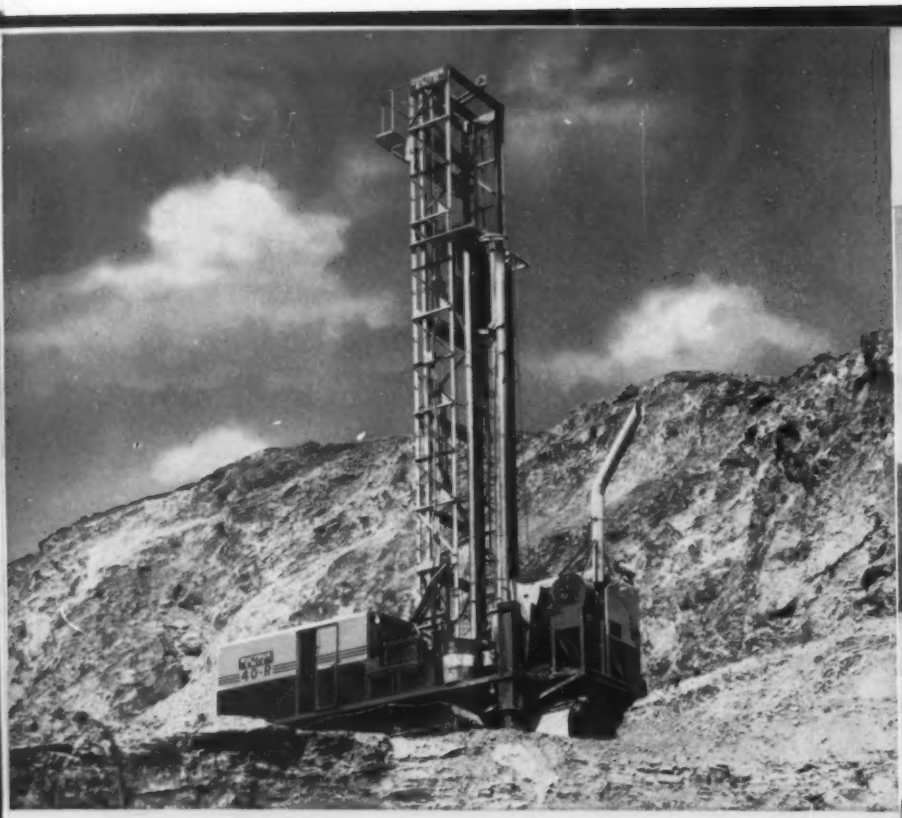
Versatile rig combines power and fast-positioning for efficient push-loading in any materials.

Tournatractor utilizes mobility and speed for quick clean-up around shovels and on pit floor.

LeTourneau-WESTINGHOUSE Company, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit



This Bucyrus-Erie 40-R is helping to raise production standards at a large open pit copper mine in western U.S.

This Bucyrus-Erie 40-R drills 9-in. holes through leached granite and a pyrite orebody containing copper.

Drilling 9-in. holes at an open pit copper mine, this Bucyrus-Erie 40-R puts down 5 times as much footage as cable tool drills previously used.

Bucyrus-Erie Rotaries Win Strong Approval in the Pits

"Enormously pleased. The 40-R surprised everybody favorably."—Copper mine operator.

"The 50-R drills do as much in one hour as a cable tool drill does in a shift."—Machine operator at a large open pit mine.

"The 40-R solved what seemed an unsolvable drilling problem by producing the necessary speed to stay ahead of the 150-B shovel."—Assistant manager of a large copper mine in western U.S.

These and similar comments are typical of the high regard owners and operators have for Bucyrus-Erie rotary blast hole drills. Since the first Bucyrus-Erie rotary was put into operation over four years ago, both the 40-R and 50-R have shattered old footage records in location after location.

There are good reasons for the popularity of Bucyrus-Erie rotaries. They offer *maximum controlled penetration* through hydraulically powered down pressure on the bit. They also provide *the most efficient drilling speed for a given formation* because of Ward Leonard electric control on rotation of the drill stem. *Hole may be drilled continuously* for the full length of a drill pipe—32 ft. 9 in. on the 50-R, 27 ft. 9 in. on the 40-R.

Bits are cooled by compressed air, and compressed air is used to remove cuttings: fine cuttings are picked up and handled by a Roto-Clone precipitator; heavies pile up adjacent to the drill hole for use as stemming material. *Manual effort is eliminated* for adding or removing drill pipe because of a remote-controlled power-driven drill pipe rack.

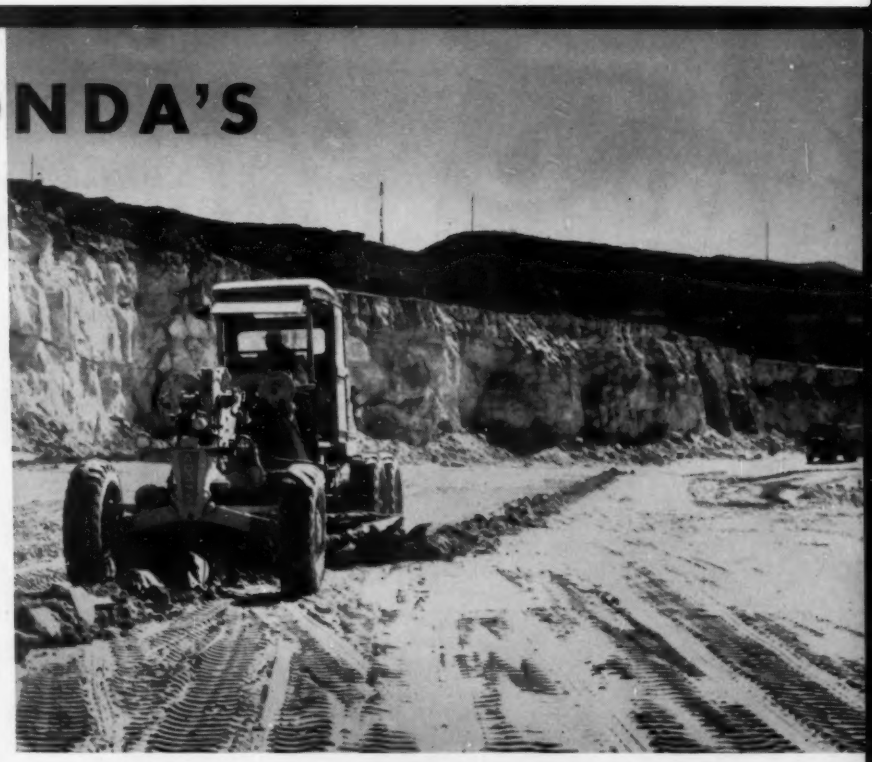
Let us tell you more about the speed and economy of Bucyrus-Erie rotary blast hole drills—the 40-R for drilling 6¾- to 9-in. holes, and the 50-R for drilling 9⅞- to 12¼-in. holes. Write today for detailed, illustrated literature. 53B57C

BUCYRUS ERIE

SOUTH MILWAUKEE, WISCONSIN

At ANACONDA'S Jackpile uranium mine:

30 miles of hauler-worn roads patrolled by ONE Adams* 550



At New Mexico uranium mine, debris dropped by passing haul units is quickly bladed aside by Adams 550 grader. Anaconda Company assigns this versatile unit to the job of keeping 25 to 30 mi. of pit haul-roads smooth and well-drained. These roads take pounding of heavy haul units 6 days a week.

Anaconda Company's 30 miles of pit haul-roads at its Jackpile uranium mine near Laguna, N.M., take the continual pounding of big haul rigs 16 hours a day, 6 days a week. To level and smooth these road surfaces — Anaconda uses one man and one machine: an Adams 550 grader.

This big 123 hp, 26,370-lb. rig has the power, weight and speed to handle the job fast and accurately. Its 8 forward and 4 reverse gears always give the operator "just right" power-speed ratio to work any type of material... give it high travel speeds to move fast to new jobs.

210 hp, 17 mph SwitchTractor helps one of Anaconda's big power shovels travel up an adverse grade. Main duties of this coupler-equipped tractor are heavy dozing at the pit, and switching of ore cars at the railhead.

Levels roads, clears away debris

At the pit, 6 power shovels work continuously to load 26 heavy-duty hauling units. A steady stream of heavy hauler traffic flows over the network of roads connecting Anaconda's pit with its various dumps and stockpiles. The fast-moving Adams grader patrols these busy roads; goes wherever needed to fill ruts, level ridges, clear debris sifting down from banks or dropped by over-loaded haulers.

Operator uses "550's" big 12′ wide blade to work loads of chipped rock, clay, and earth. Blade is fully rotatable on the circle... can be extended a full 7½′ outside line of wheels for shouldering. To trim banks, grader has a vertical reach of 12½′... cuts at angles to 90°.

Utility SwitchTractor* dozes, switches

Anaconda uses another LeTourneau-Westinghouse unit to doze heavy clean-up around shovels, and for switching of ore cars at the railhead. It's the 210 hp, 17 mph SwitchTractor — a mobile, rubber-tired rig equipped with heavy-duty dozer blade in front, and a standard rail-car coupler in the rear. Dozer-switcher moves around wherever needed, handling a variety of jobs.

Cuts operating costs

Any pit operation shows more production... more profit... when a continuous pit and road clean-up policy is followed. Heavy-duty Adams 550 grader — with its wide selection of speeds — affords you dependable one-machine service in this important maintenance job. Like other big Adams graders, the "550" has a combination of operating features not found in any competitive unit. Ask for complete details.

An Adams Grader for every size job

New POWER-Flow 660* — 190 hp with torque converter.....30,200 lbs.
Model 660* — 150 hp diesel....30,050 lbs.
Model 550* — 123 hp diesel....26,370 lbs.
Model 440* — 104 hp diesel....24,080 lbs.
Model 330* — 80 hp diesel....23,020 lbs.
Model 220 — 60 hp diesel....15,500 lbs.

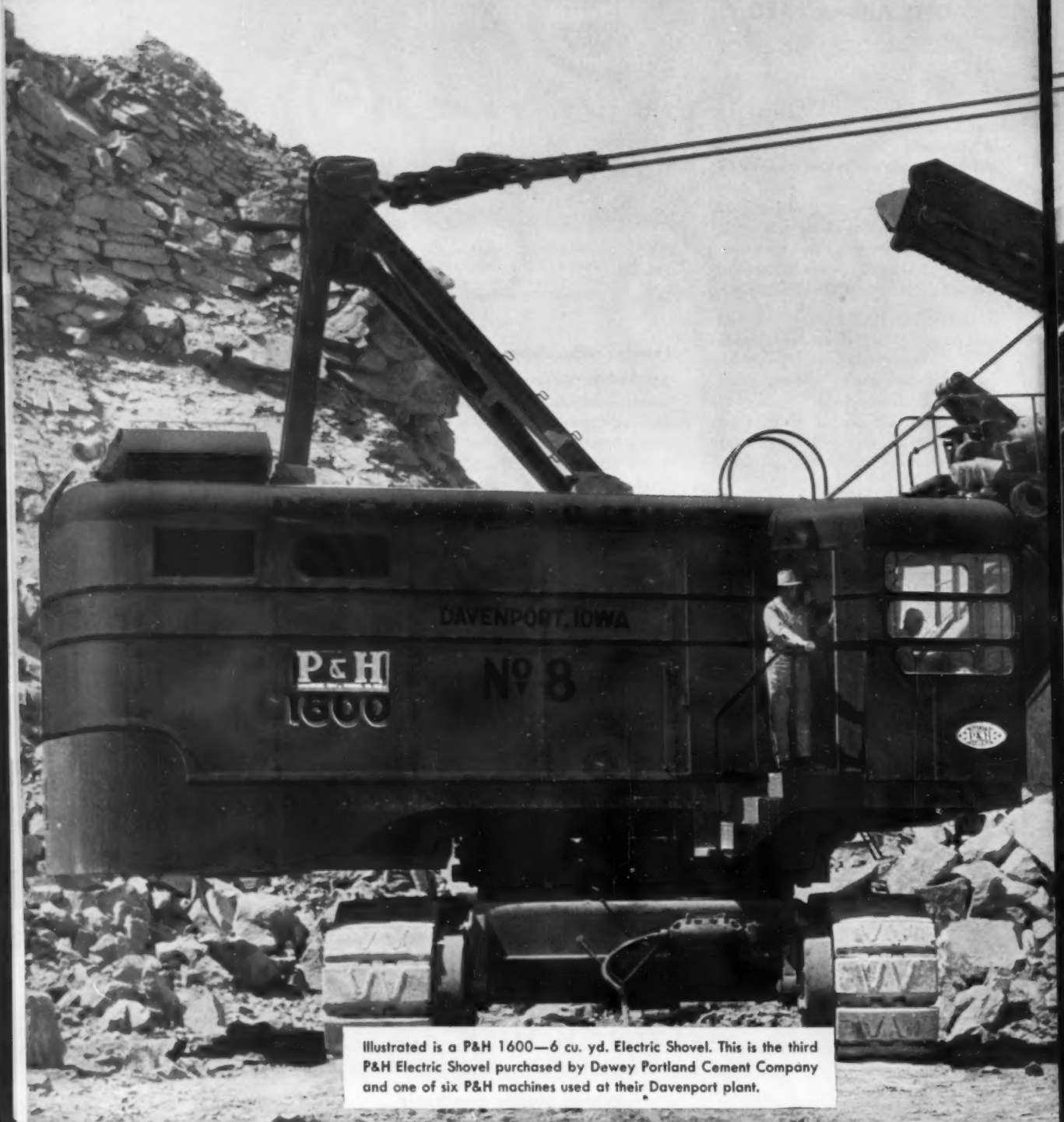
*Choice of GM or Cummins engine
(Weights shown are usual working weights.)

*Trademark AGST-1245-M-b-5

LeTourneau-WESTINGHOUSE Company, PEORIA, ILLINOIS
A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

P&H Electric Shovels



Illustrated is a P&H 1600—6 cu. yd. Electric Shovel. This is the third P&H Electric Shovel purchased by Dewey Portland Cement Company and one of six P&H machines used at their Davenport plant.

give you 95% Availability

Reports of 95% availability by users of P&H Electric Shovels are not at all unusual. This typically outstanding P&H performance is the result of these exclusive P&H designed and manufactured features!

MAGNETORQUE* ... transmits power from the hoist motor to the dipper magnetically for faster action, and at the same time, eliminates shock and impact to the hoist gear train and motor. Response is immediate to varying load conditions.

ELECTRONIC CONTROLS ... P&H designed and built to provide fastest action of any type of control available on electric shovels. All motions are smoother, resulting in consistently higher output.

P&H Basic Design ... permits scientific weight distribution to insure maximum stability with higher bail pull. All-welded construction adds ruggedness and stability needed for the toughest jobs.

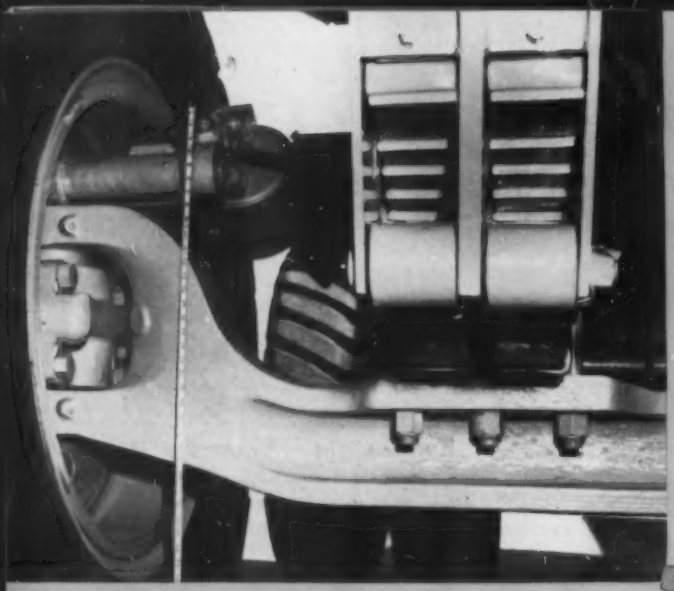
With P&H you get all of these exclusive electric shovel features ... plus the advantage of single source responsibility. P&H designs, manufactures and applies all electric rotating equipment specifically for electric shovel service.

P&H ELECTRIC SHOVEL LINE: 3½ through 8 cu. yd. capacities.

HARNISCHFEGER

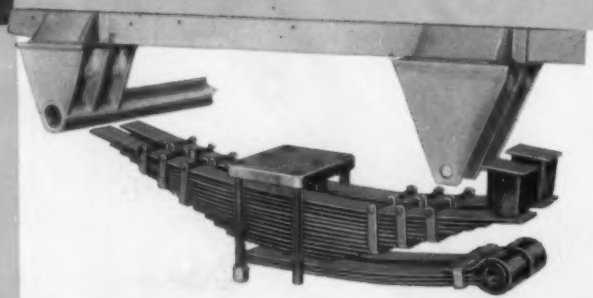
CONSTRUCTION & MINING DIVISION
Milwaukee 46, Wisconsin

*T.M. of Harnischfeger Corporation for electro-magnetic type coupling.

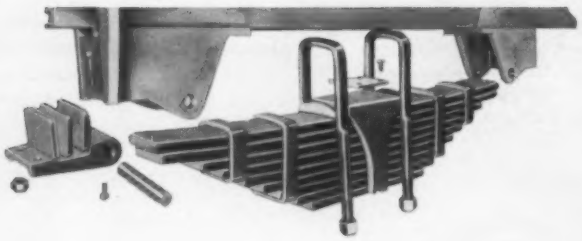


Variable rate front springs in the Kenworth 803 are typical of the specialized engineering which makes Kenworth's complete line of rock and ore movers so outstanding. Rubber-mounted at both ends, the dual springs have steel seats, adjacent to the rubber pads, that shorten their effective length under load. The result is shorter, stiffer springs to compensate for the additional load. Unloaded, the truck rides on rubber. The spring-type radius rods provide positive positioning of the front axle with full flexibility.

spring mounted



FOR COMFORT—LOW OPERATING COST



Rear springs on the 803 add to Kenworth's record of low maintenance, reduced tire cost, greater riding ease. Stiff rear springs are securely mounted in rugged frame brackets and positioned by use of steel and resilient pads. A spring shroud holds the leaves in alignment. Kenworth engineering proves . . .

. . . . *There's more WORTH in KENWORTH*

KENWORTH

MOTOR TRUCKS

FACTORY AND HOME OFFICE: SEATTLE, U. S. A., DISTRIBUTORS IN THE UNITED STATES AND MOST FOREIGN COUNTRIES

CYANAMID

REAGENT NEWS

"ore-dressing ideas you can use"

Solving Slime Problem with AERO® Depressant 633 Substantially Improves Recovery

The value of AERO Depressant 633 as a gangue slime dispersant and depressant has again been demonstrated at an African mine treating a gold ore containing about 7 dwt. Au per ton in quartz gangue.

The gold is recovered here by a combination of straking, flotation and cyanidation of roasted flotation concentrates.

At this property about 70% of the gold is free and is recovered on strakes. Recently, narrowing veins increased the proportion of wall rock in the plant feed, raising micron-sized graphitic slime content to about 10% of the feed weight. Slimes had been removed from strake tailings with cyclones followed by hydroclassification in a thickener. Increasingly high slime content of flotation concentrates reduced the ratio of concentration, caused balling in the roaster and incomplete roasting; and overloaded the cyanidation plant.

Adding AERO Depressant 633 at the rate of 0.4 pounds per long ton decreased residue values by 24.4% and increased concentrate grade by 8.5%, with only one recleaning instead of two. Strake tailings now go directly to flotation without cyclone desliming. Flotation concentrates are again being roasted and cyanided without difficulty. Other reagents used include 0.07 pounds per long ton of AERO Xanthates 301 and 303; 0.12 pounds of copper sulfate and 0.08 pounds of frother.

Perhaps AERO Depressant 610, 615, 620 or 633 would be of help in your flotation operation. These products are all excellent controllers of carbonaceous and micaceous gangue. We will be pleased to send you samples for testing.

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Toronto 1, Ontario, Canada

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Apartado No. 26012, Mexico 12, D. F., Mexico

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MINING CHEMICALS DEPARTMENT
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

DENVER-DILLON Vibrating SCREENS

2-Bearing, Spring-mounted Construction Assures Higher Capacity, Longer Parts Life— and Cuts Horsepower up to 50%

LOW POWER REQUIRED. Weight of screen and material being screened supported entirely on spring-mounted suspension rods. Only weight on the bearings is the vibrating mechanisms. Bearings are not subjected to shock loads. Horsepower needed cut up to 50%.

NO DAMPING UNDER LOADS. Entire mechanism is free floating—not tied to supporting framework through outboard bearings. No damping even under heaviest loads. Efficiency remains high and constant.

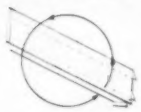
UNIFORM VIBRATION—HIGHER CAPACITY. Full-Floating mechanism transmits uniform TRUE CIRCLE vibration to every part of screen. No dead spots. Constant, full-screen efficiency gives highest capacity and longest screen life.

SAVES COST—SAVES SPACE. Elimination of unnecessary parts—heavy outer bearings and frames—reduces overall weight of Denver-Dillon Vibrating Screens by 30% to 50%. Width is considerably reduced. Cost is lower—space requirements are lower—than for 4-bearing types.

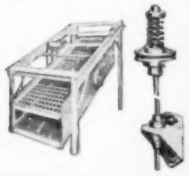
Distinctive Features:

Only 2 Bearings

Floating Circle Action



Suspended Construction



IN STOCK FOR QUICK DELIVERY

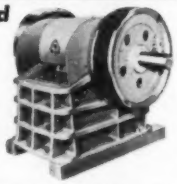
On hand is a wide range of Standard Denver-Dillon Vibrating Screens to assure you quick delivery.

Available in double deck types, either floor mounted or with suspension frame, sizes from 1' x 3' to 6' x 14'—or special types to meet individual needs—there's a Denver-Dillon Screen to answer your screen problems.

Find out how a Denver-Dillon can cut your screening costs, increase your profits. Write, wire or phone. Flowsheets for every screening job on request. Ask for Bulletin S3 B15.

DENVER *Forced-Feed* JAW CRUSHERS

IN STOCK



Denver forced-feed crushers have anti-friction pitman and side bearings. Cast steel frame on 10" by 20" and smaller sizes, welded steel frame on larger sizes to 36" x 48". Jaw plates can be inverted for longer wear. Forced feed plus extra long jaws assure highest capacity.

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Mining World
THE IMPORTANT MINING MAGAZINE EVERYWHERE
June 1957

INTERNATIONAL PANORAMA

STARKE, FLORIDA—The duPont Company will take over full operations of the Trail Ridge and Highland ilmenite plants in mid-February 1958. These plants are the largest in the United States recovering ilmenite, rutile, and zircon from beach sands. The plants had been operated by Humphreys Gold Corporation under a 10-year contract.

LUANSHYA, NORTHERN RHODESIA—Roan Antelope Copper Mines Limited set a new "Copperbelt" record in March when 530,000 tons of copper ore were milled.

GEORGETOWN, IDAHO—A new open-pit phosphate mine and acidulation phosphate fertilizer plant will be developed and built here by Central Farmers Fertilizer Company, a Chicago cooperative. More than 22,000,000 tons of phosphate rock can be mined by open pitting for the new plant.

BIRMINGHAM, ALABAMA—Republic Steel Corporation and National Lead Company have formed a new firm—R-N Corporation—to develop a direct reduction process for iron ores. Pilot plant work has been underway here at the Spaulding mine since 1954.

CHRISTMAS, ARIZONA—Inspiration Consolidated Copper Company has increased ore reserves in the O'Carroll bed to 16,000,000 tons of 1.8 per cent copper ore from 10,000,000 tons of 2.0.

AMELIA ISLAND, FLORIDA—Union Carbide Ore Company will use a rebuilt Yuba bucket line dredge to recover ilmenite, rutile, zircon, and monazite from its placer deposits here. Final concentrate separation will be done in a new shore plant.

HIGHLAND VALLEY, BRITISH COLUMBIA—Kennecott Copper Corporation's Canadian exploration subsidiary—Northwestern Explorations Limited—has resumed copper exploration here.

GRANTS, NEW MEXICO—Homestake Mining Company, operating with partners, has received its second uranium milling contract for Ambrosia Lake ores. Under the contract Homestake-Sapin Partners will build and operate a 1,500-ton-per-day mill to treat ores developed by Sabre-Pinon Corporation.

PICHER, OKLAHOMA—The Eagle-Picher Company, leading Tri-State mining company, has closed its Tri-State zinc-lead mines and Central mill because world production is greater than demand. Preliminary reports show Tri-State district production of zinc was 57,800 tons of zinc and 27,200 tons of lead.

McARTHUR RIVER HOMESTEAD, NORTHERN TERRITORY, AUSTRALIA—A very promising lead outcrop has been discovered here by Mount Isa Mines Ltd. The outcrop is about 400 feet long, 120 feet wide, and assays 10 per cent lead. Development by shafting and drilling is underway.

COPIAPO CITY, CHILE—A new firm, Japan-Chile Iron Ore Joint Venture, has been formed to develop three iron ore mines in Chile and export 1,000,000 annual tons of ore to Japan starting in 1960.

AMBROSIA LAKE, NEW MEXICO—Kermac Nuclear Fuels Corporation is building a 3,300-ton-per-day uranium mill here. It will be the largest single uranium mill ever built in the United States and is scheduled for first operation in July 1958.

CLIMAX, COLORADO—A new and enlarged byproducts plant will be built at the Climax Molybdenum Company's mill. It will replace the smaller unit which recovers tungsten, tin, pyrite, and topaz from molybdenum tailing.

SAN FRANCISCO, CALIFORNIA—In March the United States Department of Agriculture contracted to barter farm commodities for $11,300,000 worth of chrome metal, $4,400,000 in lead, and $2,100,000 in zinc for the stockpile.

TAZEWELL, TENNESSEE—New Jersey Zinc Company is expanding its mineral holdings in eastern Tennessee. The company has just purchased mineral rights on 166 acres in the Goin district of Claiborne County.

Newmont Plans To Extend Atlas Copper's Reserves

Management of Atlas Consolidated Mining and Development Corporation has embarked on a program to extend ore reserves at the Toledo copper mine, Cebu, Republic of the Philippines.

Ore reserves, last calculated in September 1956, are reported as 48,555,000 tons of positive ore assaying 0.95 percent copper and 34,978,000 tons of probable ore assaying 0.84 percent. Ore reserves are sought at Pena-Barot three miles from Toledo, and by extensions of the Atlas ore body. While extension in depth for the Toledo ore body has good possibilities, the prime object is to find and develop additional ore that can be mined by open pitting.

Newmont Mining Corporation at the first of this year owned 37,900 shares of Atlas and a special meeting of Atlas stockholders late in May was for the purpose of approving the use of Newmont's geophysical crews and geologists in this ore search.

R-N Corporation Formed To Develop Iron Process

Republic Steel Corporation and National Lead Company have formed R-N Corporation to jointly develop a direct reduction process to treat both low- and high-grade iron ores to obtain a high metallic iron concentrate.

The R-N process would provide iron feed material for use in blast, electric, open hearth, and cupola furnaces. It was first developed by National Lead, but both companies have been doing additional research and experiment work since 1954 in a pilot plant at Republic's Spaulding mine near Birmingham, Alabama. The iron produced is in briquet form. The smallest briquets are about one inch in diameter for use in blast furnaces, and the larger ones, weighing from 5 to 25 pounds, are for steel making and foundry furnaces.

According to the companies, some of the principal advantages of the process are that it will treat both non-magnetic and magnetic iron ores, which now require separate processes, and yields a product of high iron content, uniform composition, and with few impurities. Readily available low-grade fuels may be used, and phosphorous contained in iron ore in its original form is greatly reduced.

Other major steel companies that are experimenting on direct reduction of iron ore include: United States Steel Corporation, Bethlehem Steel Corporation, Jones & Laughlin Steel Corporation, and Armco Steel Corporation.

In July—How and Why Climax Uranium Uses Solvent Extraction

HIGHLY EFFICIENT operations at the Jenifer mine of Pacific Coast Borax will soon end. Underground practice at Boron went through an evolution from shrinkage stopping to the application of continuous mining machines.

$20,000,000 Face Lifting Forges

The saga of 20 Mule Team Borax enters the jet age as a new open pit replaces efficient underground mining.

Open Pitting . . . p. 38
Underground Mining . . . p. 40

By STANLEY H. DAYTON
Associate Editor

In the near future, Pacific Coast Borax Company, a division of United States Borax & Chemical Corporation, will close California's largest and certainly most efficient underground mine in favor of open-pit extraction of borate ore. And therein lies one of the fascinating mining stories of our time. For the Pacific Coast Borax operation, midway between Mojave and Barstow, marked one of the few completely successful applications of continuous mining machines outside of the coal fields. Even in the famed Carlsbad, New Mexico potash district where continuous miners have been used extensively, ore production, with perhaps only one exception, is augmented in large measure by drilling and blasting methods. For an up to date report of open pitting see p. 38.

Nowhere are the fruits of progress more forcefully demonstrated than at the tradition wrapped operations of Pacific Coast Borax. Ever since cottonball (efflorescent crusts of borax and ulexite) was first handpicked on the floor of Death Valley and hauled by 20 Mule Team to Mojave, California, borate exploitation has followed a pattern of continual progress. When PCB shifted development from Death Valley in 1927 to the present center at Boron, California, under-

NEW OPEN PIT will lead to greater, more economical extraction of borax, and will permit expansion as demand for products grows. In the background is the new refinery built by Southwestern Engineering Co. and Ford J. Twaits Co.

New Era For Pacific Coast Borax

ground, borate ore beds were developed by underground open stoping. Mining then underwent an evolution to modified shrinkage stoping with electric auger drilling. In 1951, Joy continuous miners with shuttlecar and belt haulage further streamlined underground production.

Today, many observers are predicting a bright future for borax. And Pacific Coast Borax has launched a plant expansion and improvement program which is now nearing completion. Isbell Construction Company is rushing a new open pit into production (see MINING WORLD March 1956, page 44) in the shadows of the mine headframes. An $18,000,000 refinery, adjacent to the open pit, is being built by Southwestern Engineering Company and Ford J. Twaits Company.

It is difficult to single out a single factor which contributed most to the decision to undertake the above projects. Open pit mining will permit virtually 100 percent extraction of the borate deposits. Presently some 60 to 75 percent of the ore now remains in room and pillar headings as well as pillars separating mining horizons. And pillar recovery at best is always an expensive process. It is true that open pitting will yield a somewhat lower average grade of ore. But offsetting this factor is the development of new ore processing methods which make it possible to economically treat such ore. Then in the background are the results of this modern industrial age. There has been a tremendous improvement in earth-moving equipment and open pit techniques in the past 10 years.

Centralization of mining and treatment at the site, three miles north of Boron, will provide transportation economies. In the present operations a portion of the ore is processed by magnetic means at a mill adjacent to the mine and the concentrates are shipped to various users. The balance of the ore is shipped by rail to the refinery at Wilmington, California, 209 miles away where the refined products are produced. The new plant will combine a large portion of the present Wilmington function with that of the present mill.

And finally, the new projects will put Pacific Coast Borax in a position to expand almost indefinitely. Demand for borax continues to grow as the new uses and new products are developed. The company will be in a position to increase production with a minimum of capital outlay.

RIPPERS AND SCRAPERS were employed on initial 10,000,000-ton stripping project, contracted to Isbell Construction Company. Working two shifts per day, Isbell moved about 25,000 tons of overburden. Shown above is a Euclid S-18 scraper being push loaded by a Caterpillar D-9.

POWERFUL scarifier employed at the project was this Caterpillar D-9 with a hydraulic ripper.

OVERBURDEN was moved at 25,000 tons per day on two shift basis. Shown above is a Euclid S-18.

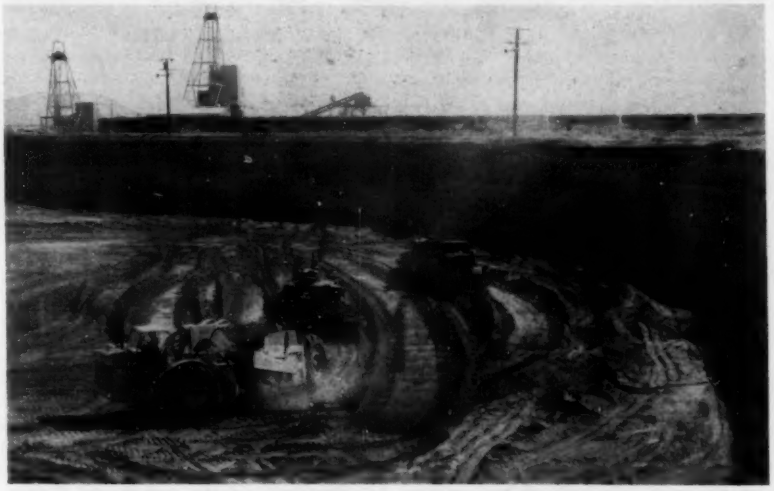
Growing Borax Demand Spurs Development of New Open Pit

At 137 feet below the table-top smooth desert surface, Isbell Construction Company exposed the world's largest known sodium borate ore body at Boron, California. And this month Pacific Coast Borax Company started mining operations as a $20,000,000 construction and development program neared completion.

Here are a few facts concerning the mine. The present pit limits measure about 900 feet by 1,200 feet. The cut is fully protected from flash floods by an extensive system of dikes. Overall pit slope is to be 1.4 to 1. Benches in the overburden are 50 feet high; in ore the exact height has not yet been determined, but original plans called for 50 feet. Mining equipment includes Bucyrus Erie 54-B shovels equipped with oversize 3-yard buckets because of the light, non-abrasive ore; Kenworth model 802 rear-dump trucks, and electric auger drills. Preliminary testing of the auger drills during a sampling campaign yielded very high penetration rates.

The crusher is now located at the refinery, but later will be moved to the bottom of the pit with belt conveyor transfer of ore to the plant.

$20,000,000 CONSTRUCTION and stripping program nears completion as the open pit reached the 135-foot depth in late April. First borax ore was encountered at this horizon. Shown in the background is the new refinery built by Southwestern Engineering Company and Ford J. Twaits.



OPEN PIT development takes place adjacent to the service and muck shafts of the Jenifer mine. Overburden consists of alluvial sand and gravel, tuffaceous sandstone, conglomerate, limestone and shale. The dump is located about a mile from the open pit; some of the overburden was used to construct dikes for flood prevention and to dam the tailings area. Equipment shown in the picture includes a Euclid S-18 scraper (lower center), a Euclid 12TDT scraper (at right) and Caterpillar D-9 pushers.

NEW REFINERY centralizes operations at Boron, and features nearly complete automatic control. Also included are four of the largest totally enclosed thickeners ever constructed. These latter were furnished by Process Engineers, Inc. Ore treatment consists of crushing to 4 inches; bedding in stockpiles by a stacking conveyor; crushing to ¾ inches and disolution in steam jacketed agitators. Solids are removed by screening and countercurrent thickening. Other units include crystallizers and an anhydrous borax plant.

JENIFER MINE was completely mechanized and highly efficient; it will soon be shut down, however, in favor of open pitting. The headframe in the background is over the service shaft; conveyor in foreground delivers ore to a car loading center.

Borate Ore Cut and Loaded In a Continuous Operation

Continuous mining machines proved completely successful for stoping ore in room and pillar headings even though borates are harder than coal

Though continuous underground mining of borate minerals will soon give way to open pit recovery, the practices used were so novel and important (tonnage per man shift is outstanding) that they should be spread on the record. The underground mine is extremely clean; you can visit the various workings in a business suit. A regular underground city exists with well equipped machine and repair shops; and rightfully so, because maintenance is given top priority since mining proceeds around the clock on an unbroken, three shift basis. A well stocked warehouse with complete high and low inventory records is maintained underground. Ore is produced in an almost steady stream from the time it is cut at the face until it is automatically loaded on 4.7-ton capacity skips for hoisting to the surface.

Pacific Coast Borax produces about 70 percent of the borate ore mined in Southern California. This figure is even more impressive when you consider that California accounts for 90 to 95 percent of the total world production of borax. PCB has constantly pioneered in production methods. W. H. Wamsley, mine superintendent, encourages his engineers and supervisors to think about routine problems and possible improvement. This climate has produced a highly efficient, well organized operation. Continuous miners mount timing devices for study of actual cutting time; company-installed grade indicators on the miners are a great help. Plastic sealing of ventilation brattice and shop-made ventilation tubing are other features to look for in the report to follow.

Kramer District

The mine is located in an area generally described as the Kramer borate district. The borate ore beds occur at depths of 130 to 1,000 feet below the surface. The principal mineral is tincal; kernite and colemanite are also quite commonly found along with the fascinating mineral ulexite which has the property of transmitting images from one opaque surface of the mineral to an opposite opaque surface. Tincal dehydrates rapidly on exposure to air to form tincalconite which carries five molecules of water.

The Kramer District is generally described as a basin of deposition underlain by basic lava flows; the latter form the basement of the series. Overlying the ore and shale is a layer of alluvium averaging some 300 feet in thickness. Below the alluvium the borate deposits are found interbedded

with Tertiary shales to depths of 300 to 1,000 below the surface. The shale envelope protects the borate deposits from the action of ground water.

Common Borate Minerals Found in Kramer District, Southern California Together With Composition

Tincal	$Na_2B_4O_7 \cdot 10H_2O$
Kernite	$Na_2B_4O_7 \cdot 4H_2O$
Colemanite	$Ca_2B_6O_{11} \cdot 5H_2O$
Ulexite	$NaCaB_5O_9 \cdot 8H_2O$

Three Horizons

Three producing horizons have been developed at the mine with each horizon separated by 30 to 40 feet of shale containing low-grade borate mineralization. The general strike of the ore bodies is southeast-northwest; the tabular, irregular mass dips at a low angle (10 to 15°) to the south and east. The bottom of the individual beds roll and undulate creating localized slopes of 20 to 30 percent. Present underground activities are confined to the flatter portions of the deposit. The ore is quite strong and stands well. During mining, ore is left on the footwall and the handing wall to support weaker shale members above and below the stopes. The geology of the district is complicated by numerous faults and pitches. Major faulting follows a northwest trend and usually shows normal throws with displacement varying from a few inches up to 50 or 75 feet.

A total of seven shafts were sunk to develop various portions of the PCB holdings. Only two, a muck shaft, and a service shaft, are now active and they are located at the Jenifer unit. The other shafts, however, are in operating condition and the West Baker shaft figures importantly in the mine ventilation circuit; some control of underground temperature is maintained by varying the seasonal volume of air introduced to the Jenifer workings from the West Baker shaft; but more about that later.

Crushing and automatic skip loading facilities are installed just below the 370-foot level of the Jenifer muck shaft. A 1,200-foot winze on a 20 percent grade, containing a belt conveyor, bottoms at the lowest mining level. The winze conveyor gathers ore from various entry conveyors and discharges to the underground crushing station at the shaft.

Harder Than Coal

Though borate ore is harder than coal, the application of continuous miners has been quite successful. The borate deposits have an even texture and lack the abrasive impurities often associated with many coal deposits. Output is obtained from a modified room and pillar stoping method using shuttlecar delivery of the ore either directly or indirectly to entry conveyors. Entry conveyors, in turn, discharge to the winze conveyor.

CONTINUOUS MINING was applied at the underground Jenifer mine of Pacific Coast Borax with outstanding success. This picture shows a Joy 4JCM machine at work. The continuous miners drove headings 8 feet high by 17 feet wide.

Development headings to stoping areas are spaced on 40-foot centers. This means that pillars between headings are 23 feet wide since the continuous miners cut a 17-foot wide entry. The pillars are holed every 100 feet or so. In stoping areas headings are driven on 40-foot centers one way and 45-foot centers in the other direction, leaving rectangular pillars 23 feet by 28 feet. Where more than one level is mined, the pillars in the upper horizon are super-imposed on the pillars of the lower horizons. Though the ore stands well, rock bolt support is needed for occasional slabs. Expansion shell bolts are favored because split wedge bolts tend to penetrate deeper into the soft ground when they are tightened.

Development headings are usually planned to follow the strike of the ore so that haulage benefits. Electrically-powered shuttlecars and continuous miners will not operate economically at grades over 15 percent. Available for the job of extracting the borax are five, Joy 4JCM and one, Joy 1PM, continuous miners; 12, Joy 10 SC shuttlecars with 7 to 8-ton (borax ore) capacity; 9 Jeffrey entry conveyors and, of course, the permanent winze conveyor.

The Joy 4JCM machines have a cutterhead containing six, parallel, endless chains laced with a total of 168 Carboloy CC-3 or Firth Sterling C7S tungsten-carbide tipped bits. Bits are sharpened four to six times before they are discarded. The average life is 40,000 tons of ore. The cutter chains operate similar to a belt conveyor traveling around the tail pulley.

CUTTING TIME at the face was increased by keeping one shuttlecar constantly with the continuous miner; loads were transferred to a second Joy 10SC machine for haulage.

JOY 10SC shuttlecars traveled from the face to a transfer raise or entry belt; these units were powered by 250-volt DC current supplied from selenium rectifiers through cable.

The bits act as cutting teeth and actually rip and tear the ore from the face. The cutterhead swings from the floor to the back taking an 18-inch deep and 30-inch wide cut each time. A vertical pivot allows the cutterhead to swing from side to side of the centerline of the heading. The continuous miners will drive a heading 17 feet wide by 8 feet high. Where ore is thicker than this it is mined in slices starting at the top. When the second or lower slice is taken, a tree bench is advanced. The continuous miners are mounted on tracks. They cut and load the ore in a single operation and feature hydraulic controls.

The Mining Team

A mining team consists of two Joy shuttlecars, one continuous miner, a portable transformer and a portable, 100-kilowatt, selenium rectifier. The latter two units are spotted as near the face as practical for optimum electrical efficiency. Power is carried into the mine at 2,300 volts AC and transformed to 440-volts AC for operation of the miners; 2,300-volt mine power must be rectified to 250-volts DC for the shuttlecars. The electrical connection with the continuous miners is provided by up to 300-foot lengths of Hazacord, 4/0 type G, trailing cable. Joy shuttlecars mount a cable reel with up to 550 feet of Hazacord Number 2, flat, type G, trailing cable connecting the haulage unit with Joy circuit breakers leading from a rectifier. One Westinghouse package "mine distribution center" and five General Electric portable transformer stations handle the load to the miners.

STUDYING MAP of underground workings which is posted at a convenient location are Pete Conte, assistant mine superintendent (left) and John Gillespie, mine foreman (right). Note the cutting marks in the wall left by a continuous miner.

PCB keeps quite a close record of the performance and efficiencies of individual machines. Each of the continuous miners for instance is equipped with a timer to indicate actual hours of cutterhead operation. Daily records of tons handled and hours worked are compiled for maintenance purposes. Each miner averages 3.6 hours of actual cutting time at the face each shift. The average advance of an 8- by 17-foot heading is 40 feet per machine shift. The miners are equipped with grade control and level-bubble attachments. The vertical circle of the grade indicator is marked in increments so that the continuous miner can be held to a pre-established grade as the heading is advanced.

Surge Capacity

At PCB the practice is to utilize one shuttlecar as surge capacity with each operating machine. This shuttlecar always stays with the continuous miner and discharges the ore cut by the miner to a second shuttlecar which trams the ore to a transfer raise. Only one shuttlecar travels into and out of each working face; this cuts down on traffic and minimizes delays. At the same time if a shuttlecar is held up a short time the effect is not quite so noticeable because of the extra holding capacity available in the surge car. This method of transportation has enabled the continuous miners to pile-up more actual working time at the face.

The 7- to 8-ton capacity Joy 10SC shuttlecars feature four wheel drive and steering. They have dual controls and operate equally well in either direction. The operator always faces the direction of travel. The bottom of the shuttlecar hopper contains a chain conveyor with bar flights which is

used for both loading and discharging ore. The maximum haul limit, without causing delay at the continuous miner, is 600 feet to a transfer raise; normally about one to 1½ minutes are required to dump the load from the shuttlecar. Transfer raises funnel ore from upper workings to entry conveyors on the lower level. In the lower workings, the shuttlecar may discharge directly to a belt loader or to the entry conveyor itself. Haulageways are sprinkled once each shift to control dust. In addition roadways are patroled each shift by using drags on shuttlecars to smooth out ruts and fill chuck holes.

In so far as possible, transfer raise holings are centrally located to provide a downward haul for loaded shuttlecars. Where a transfer raise system is necessary for muck disposal at upper levels, the raise is collared in the back of one of the lowest entries in the mine. The raise is driven 5 by 5 feet in cross section using air stopers. After holing the upper level, the raise is ring-drilled and blasted-out using fast-delay electric caps to make a 12-foot diameter section. A timbered chute is installed at the bottom of the raise with a Jeffrey vibrating feeder mounted at the chute mouth. The 30-inch wide, Jeffrey, entry conveyors are spotted so that they plumb the raise and the chute, and the entry belts discharge to the winze conveyor leading to the underground crushing station. Two or three entry conveyors may radiate from the lower end of the winze conveyor to serve the various producing sections of the mine.

Winze Conveyor

The 10- by 15-foot winze, connecting the lower level with the crushing plant, is on a 20 percent slope; it is actually divided into two compartments. The footwall is tracked with 30-pound mine rail; a 350-horsepower, Vulcan, hoist, fitted with 1,200 feet of 1⅜-inch, flattened-strand, Hercules wire rope, is installed on the upper level near the crushing plant; it hoists service cars which travel on the track. The upper or hanging wall half of the winze contains an 1,150-foot Joy conveyor which is 30 inches wide and capable of handling 350 tons per hour. A solid timber curtain, forming the conveyor walkway, separates the conveyor compartment of the winze from the footwall service compartment. The winze conveyor, powered by a 100-horsepower motor, has a Westinghouse gear-drive, and

Boron Enters Romance Field

There are literally hundreds of uses for borate compounds. But boron chemistry, still in its infancy, is providing our nation with a whole host of new, exciting developments for this element. Jet and rocket fuels, for instance, have been mentioned in the past year as a possible outlet for borate production. Little is known of the many developments for boron now underway in research laboratories all over the United States. But this much is certain. Based on scattered reports, the future looks bright for producers of borax. And this statement is further strengthened by the moves towards expansion now being made by three major firms in the Southern California desert where 95 percent of the world output is produced.

Chief among these is United States Borax & Chemical Corporation which is by far the largest single producer. New mine and plant facilities will enable it to expand indefinitely as the growing demand for borate products dictates.

The following applications are some of the possibilities which researchers have indicated may provide a continually growing market for borates. But along with these must be considered the present familiar outlets for borates and boron compounds. Of the estimated 1,000,000 ton boron mineral production in California last year, nearly half this amount found its way into the glass and ceramic industry. Boron is being used in increasing amounts in fertilizers, and of course, it has long been used in cleansing agents. Glass, glass fibers, porcelain enamels, fertilizers and cleansing agents lumped together will account for about 75 percent of the 1956 use of borax.

In recent years these new uses have been mentioned for boron.

PHARMACEUTICALS: The pharmaceutical industry is interested in several properties offered by boron compounds. Certain borohydrides, compounds of boron, hydrogen and oxygen, have found application as reducing agents in the manufacture of pharmaceuticals and chemicals. Compounds of boron may prove the answer to several synthesis problems confronting this industry.

AUTOMOBILE FUEL: Certain gasoline producers are using an organic-boron additive in automobile gasoline. It is claimed that the compound prevents metallic deposits from forming in the cylinder head of the engine causing knock and power loss.

SUPER HARD SUBSTANCE: Just a few months ago General Electric Company announced that it had synthesized a substance at least as hard as diamonds if not harder. Called borazon, the product is boron nitride and possesses a cubic crystal lattice. Borazon is produced from a substance commonly known as white graphite which has the normal hexagonal structure of boron nitride, using tremendous heat and pressure. Borazon is hard enough to scratch diamond, and in addition, is far more heat resistant. Whereas diamonds will oxidize at 1,600° F., borazon will stand temperatures of 3,500° F. The logical application of borazon would be in industrial tools.

HIGH ENERGY FUELS: Both lithium and boron chemical compounds with hydrogen have been investigated as possible fuels. While little has been published, it appears that boron, while chemically locked with hydrogen, is capable of controlling the extremely rapid combustion rate of hydrogen, thus reducing the explosion hazard. Since boron is one of the lightest of the elements, it presents definite advantages for use in jet fuels, or in rocket propellants, missiles or aircraft.

NUCLEAR USES: A variation of boron, boron-10, has a very high neutron cross section, which means that it is capable of absorbing neutrons without becoming radioactive. Because of this, boron-10 looks attractive for certain atomic reactor components. Examples of potential uses are in shielding materials, or for the control rods in the reactor core which sop up excess neutrons thereby providing a control over the rate of fission.

BORIDES: These are among the hardest known metals. This substance is quite refractory, and looks interesting for use in construction of jet engine turbine blades and nozzles. Boric oxide is the basic material used in production of the borides, and last year, boride output provided one of the major markets for boric oxide.

PLASTICS: For aircraft use plastics are needed that will retain their flexibility over a range of temperatures varying from minus 40°F. to over 1,000°F. With the help of boron such plastics may become available. Boron-phosphorous and boron-arsenic compounds have been found to possess properties which may make them useful in the synthesis of light, high-temperature-resistant plastics.

COMPLETELY equipped shop and repair facilities were maintained underground. Maintenance was highly important.

PARTS WAREHOUSE was established underground with complete high and low inventory control. Warehouse and shop facilities made the mine self sufficient, and were necessary for maximum efficiency. Shown above is warehouseman Bryce Slimp.

utilizes Joy troughing and return idlers.

This installation delivers the ore to a surge bin ahead of a Pennsylvania, 30- by 60-inch, single-roll crusher with a set of four inches. This crusher was installed before the present system of continuous mining evolved, and actually is not vital to today's operating requirements of PCB. Much of the fine muck produced by continuous miners by-passes the crusher to the automatic, skip-loading facilities of the Jennifer shaft.

Automatic Skip Loading

Skips are loaded automatically by a Link Belt designed installation. Ore from the Pennsylvania crusher drops into a 200-ton capacity bin with two chutes from the bottom leading to the two, shaft skipways. The lower lips of the two chutes rotate in a vertical arc, and each is counterbalanced so that they normally are in a vertical position when not loading. As a skip is lowered down the shaft it encounters a stirrup connected to a chute. The force of the skip riding on the stirrup in the shaft lowers the counterbalanced chute and allows muck to flow from the bin to the skip. Since the lip of the chute actually extends at a 45° angle down into the skip, the flow of ore is blocked by a damming action when the skip fills to capacity. The rim of the skip encounters the chute lip as the skip is hoisted. This provides the momentum to return the lower, hinged section of the chute to its normal, vertical position preventing further ore from flowing from the chute. The operation is repeated in the next compartment when the second skip is lowered and the first skip reaches the dump irons in the headframe. The cycle is controlled by the hoistman. Loading a 4.7-ton capacity skip on the bottom requires 4 seconds; when the skip in the dump irons is unloaded, the hoistman knows that sufficient time has elapsed to load the bottom skip. Hoisting capacity of this semi-automatic system is 400 tons per hour.

The Kimberley-type skips are hoisted at 1,200 feet per minute. The hoist for the Jenifer muck shaft is a 500-horsepower, Nordberg, double-drum unit. The drum faces measure 52 inches wide by 7 feet in diameter, and are wound with a total of 950 feet of 1¼-inch, Hercules flattened strand, preformed wire rope. The cage in the service shaft, 350 feet northwest of the muck shaft, is operated by a Vulcan Iron Works 150-horsepower hoist.

Notes On Ventilation

Dust control and ventilation are very important at the mine. The soft ore has a tendency to dust due to two reasons. First, the continuous miner produces small, relatively fine cuttings. Also, roadways in operating headings receive a considerable pounding from shuttlecars. Water sprays can not be used to control dust produced by the continuous miner, because moisture in the ore interferes with magnetic separation of borax and gangue. Though roadways are sprinkled each shift, care must be used in the application of the water. Usually a double entry method of room and pillar is employed. The return air course is carried on the left with fresh air circulated to the continuous miner working in the heading on the right.

The main fan, a Joy, Model H unit, rated at 150,000 cubic feet per minute, is located at the service shaft. This fan draws air down through the Jenifer service shaft and puts the mine workings under pressure. 25,000 cubic feet of fresh air is supplied to each working face; circulation is supplemented by a Joy 20,000-cubic-foot-per-minute fan on each of the continuous miners. These latter fans draw dust-laden air from the face and discharge through shop-made tubing to the return ventilation course. Return air courses are chosen which have no machinery installations so that frictional loss is held to a minimum. Air flows out of the mine through the Jenifer muck shaft. Most of the intake air is supplied from the service shaft, about 350 feet from the ore-hoisting shaft, but about ⅓ of the total is obtained from the West Baker shaft at the extreme western end of the property. This arrangement has the advantage of furnishing cool air in the summer and warm air in the winter. West Baker air travels a longer course to working faces and is therefore warmed due to friction and compression. Increasing or decreasing the ratio of air furnished through the Western Baker is an ideal means of

providing seasonal temperature control.

Plastic Sealants

There is one other consideration. Room and pillar mining results in a myriad of open passages which must be sealed off to prevent undue loss of air from working sections of the mine. The many worked-out headings provide more opportunity for leakage than normally encountered in metal mines. The installation and use of brattice bulkheads and curtains at PCB has reached a high degree of efficiency. Eighteen men on the three shifts specialize in ventilation control work. This crew also does most of the roof bolting which is required.

One of the most interesting ideas to be developed at the mine is the use of a spray which is applied to brattice cloth and curtains by means of a pressure gun. As the spray dries it hardens and provides a good seal. The plastic compound is supplied by Better Finishes & Coatings, Inc. of Los Angeles, and is quite similar to compounds used to seal Navy ships which have been retired from active service and placed in the mothball fleet. The plastic spray is applied to the edges and seams of the brattice cloth which is actually nailed to the ground. Special pains are taken to apply a good coat of spray at the junction of the cloth and the ground. Application of the spray has saved millions of cubic feet of air which normally would be lost through leakage to worked-out headings. Where headings are 20 to 25 feet high in cases where two or more lifts are mined, brattice cloths are dropped from the back to within 9 feet of the floor. These control curtains, spaced on 40 and 45-foot centers, put the air where it is needed most—at the working level.

Another idea developed at the company is the use of shop-made ventilation tubing on the blower side of the Joy fans mounted on the continuous miners. These fans, installed ahead of the operator-controls, are necessary for dust-free operation at the face. The fan sucks dust laden air at the face for discharge to return ventilation air course. The shop-made tubing is actually a 75-foot long strip of water-proofed canvas which is folded once along the long dimension. The free side is then joined by stitching with a sack sewing machine. This idea and the plastic spray application are two examples of cost saving methods developed by supervisors on the staff.

Preventive Maintenance

Preventive and routine maintenance occupies a high place in the sun at Pacific Coast Borax. Since operations are on a 24-hour basis the company has adopted the attitude that production is only as efficient as the regular servicing and repair program allows it to be. The shop facilities are extremely well organized under the guidance of master mechanic Joe McCune. With the swing towards open pitting, systematic training is already underway to develop an efficient program for heavy equipment.

Continuous miners and shuttlecars are serviced every 16 hours with a general lubrication. Gear cases on these units are flushed and changed every 300 hours. After any unit, either shuttlecar or continuous miner, has handled 100,000 tons of ore it is brought to the shop where it is completely torn down and disassembled to the ground. All parts are closely inspected, motors are checked; gear cases, pins, bushings and electrical connections, and every little nut and bolt is carefully gone over. Then the machine is rebuilt and put back in service.

Service records and lubricating sheets are maintained for each unit. Charts are kept of the amount and type of lubricant used in an attempt to uncover hidden troubles.

With the underground operations progressing so smoothly it is hard to visualize the approaching change to open pit mining from a preliminary examination. The simple fact is that open pitting will permit certain economies, and will also leave the company in a position to rapidly expand if demand and product development create new markets for borax. Specifically, here is what open pitting will do:

1. Will permit extraction of ore now left in vertical and horizontal pillars as well as ore remaining on the back and footwall of present stopes.
2. The combination of better ore treatment and open pit mining will permit lower grade ores separating mining horizons to be extracted.
3. Demand for borax looks good and PCB can readily expand output with a minimum of capital outlay.
4. High cost pillar recovery will no longer be a problem.

The swing to open pitting is another example of the leadership PCB has maintained in the borax field. The company has had a long and successful history, and once again is entering a new era as it has so many times in the past.

THE END

CAR LOADING distribution center was the end of the line for the ore at the Jenifer mine plant. From here the ore was delivered to the mill in covered, hopper-bottom cars. The former mill used an all-dry concentration process.

DEEP DRILLING equipment at Ambrosia Lake. The heavy-duty, truck-mounted drill operates 24 hours a day. Note the water tank truck and the sacked bran on top. Drilling mud and bran coat hole walls to prevent caving.

Fast Drilling . . . Gamma Logging . . Scientific Evaluation . . .

Assures Accurate Low Cost Results In Deep Hole Uranium Exploration

By E. P. CHAPMAN, JR.

The exploration geologist and the drilling contractor—both diamond and rotary—have written a new chapter in mineral exploration and ore body evaluation in the Ambrosia Lake uranium district. Ambrosia Lake, New Mexico has been the scene of the largest drilling campaign in the century's greatest prospecting rush. Fortunately drilling and evaluation have delimited very substantial ore reserves.

Mr. Chapman is a partner in the Albuquerque, New Mexico consulting engineering firm of Chapman and Wood. This firm has supervised the drilling, logging, and evaluation of many hundreds of thousands of feet of drill hole in Ambrosia Lake.

New drilling techniques have been developed and accurate methods of radiometric logging and gamma log ore evaluation have been perfected. These have all cut exploration costs which have been high because of the deeply buried ore horizons—as much as 2,000 feet, but averaging close to 700.

Ambrosia Lake is a rather broad, flat, dry basin lying some 20 miles northeast of Bluewater and 30 miles north of Grants, McKinley County, New Mexico. The basin surface consists essentially of a thin silty alluvium encompassing scattered low outcrops of Mancos shale or sandtone. Small scattered intermittent lakes sometimes form within the basin, caused by heavy run-off from thunderstorms or melting snow.

Uranium deposits of commercial importance were first discovered in the Grants area in 1949. Following the intial discovery thousands of mining claims were staked on public domain for many miles north of the belt in which the Haystack Mountain Development Company's Haystack, Poison Canyon, and other mines were producing substantial quantities of uranium ore from near surface deposits in the Todilto limestone and Morrison formation. The Ambrosia area was almost completely staked during this period. However, the entire sedimentary series dips at from 3° to 6° to the north-northeast toward the San Juan Basin from the early discoveries, while the topography gently rises in the same direction so that in a very few miles the

favorable horizons are rather deeply buried.

In the early 1950's drilling depths at Ambrosia were considered to be beyond the limits of economic feasibility. This concept was abruptly changed in the spring of 1955 when commercial uranium was discovered in a drill hole at a depth of 340 feet in what has variously been termed the Mid-Continent, the Dunn Brothers, and the Dysart deposit, which is presently being mined by the Rio de Oro Uranium Mines Corporation.

Problems in Making Hole

The major drilling problem faced by the drillers at Ambrosia Lake was learning the techniques required to handle properly the depths involved. Earlier shallow open hole drilling in the Grants district had utilized air sweeping techniques which proved inadequate for the 600-to-1,000-foot holes required to penetrate the Ambrosia ore horizons. A change to water as a drilling medium solved the problem but created two new ones. Water at Ambrosia was a scarce and precious commodity and rights to the few scattered water wells and stock tanks in the district were soon at a premium. In addition, the pumping of water through the somewhat bentonitic mudstones of the Brushy Basin and the soft, porous gypsiferous sands of the Westwater Canyon created conditions under which holes caved badly, hampering and even preventing completion to the desired depth and subsequent probing. Initial attempts at coring the ore horizon were especially frustrating. The hole caving problems were magnified by the greater length of time required for core drilling and many diamond bits, thousands of feet of drill rod, and a great deal of casing have been abandoned in uncompleted holes. When core holes were completed, recovery of the water-softened, ore-bearing sandstone was often quite low.

In a large measure these problems were overcome by changing from single shift to 24-hour drilling to cut to a minimum the time between opening up of the trouble-making strata and completion of evaluation of the hole; by using drilling mud and bran to coat hole walls; by drilling open hole to slightly above the ore horizon and coring only the zone of potential interest; and by taking large diameter cores.

Proper Deep Hole Evaluation

The importance of the final drilling problem at Ambrosia Lake scarcely can be over emphasized. The problem is concerned with the proper evaluation of deep drill holes. An illustration of the tragic consequences of over-optimistic interpretation of radiometric probing results appeared in the annual report of one of the larger, better managed uranium companies about 20 months ago. This report stated that an ore body estimated to contain 3,500 tons of 0.36 percent U_3O_8 ore, on the basis of radiometric probing of drill holes, had been opened up by 165 feet of sinking and several hundred feet of drifting. Several hundred tons had been shipped at an average grade of 0.12 percent U_3O_8 and mineralization had been found to be spotty and erratic. It was concluded that radiometric results

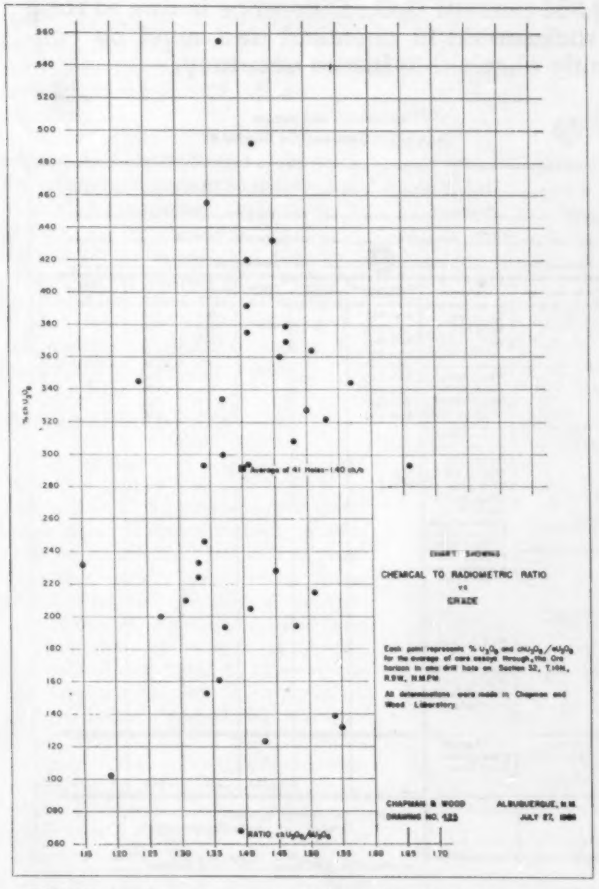
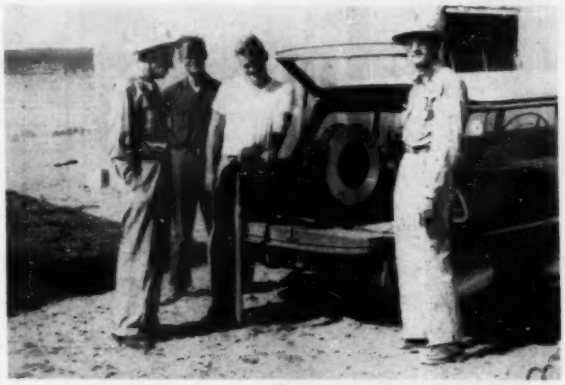
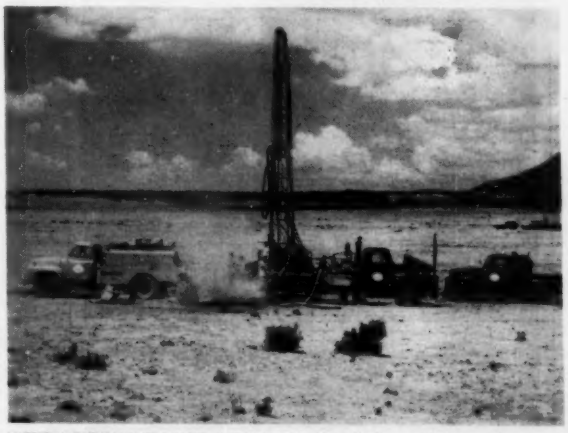


CHART for determining chemical-to-radiometric ratio to find percent U_3O_8 in ore body. Remember that this ratio varies and must be checked regularly to assure accuracy.



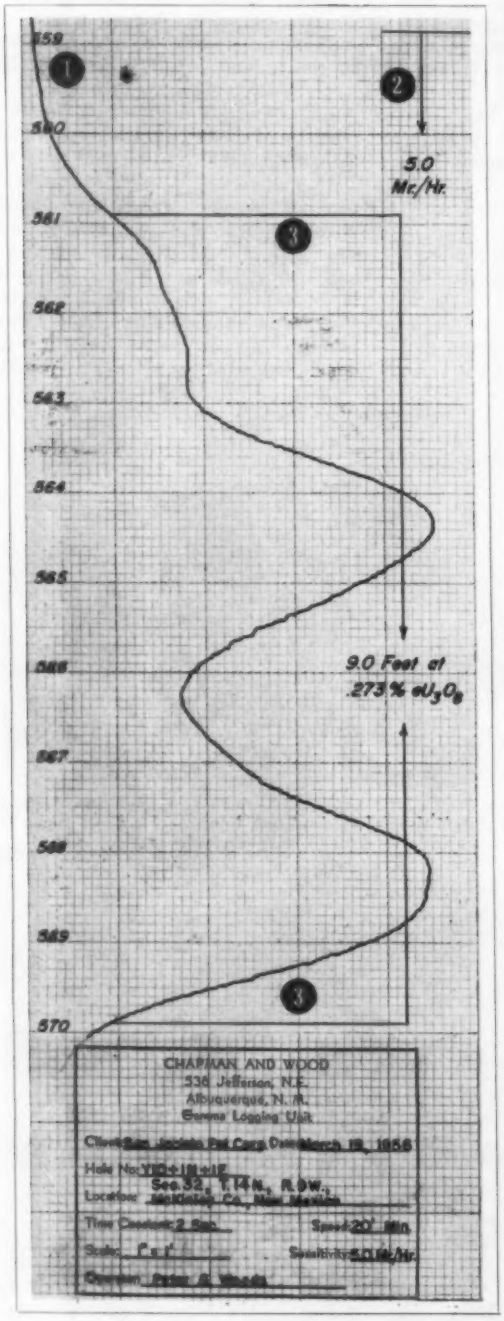
GAMMA LOGGING UNIT with Welltab recorder is mounted in this station wagon which moves from hole to hole. Probe is lowered directly into hole. Author Chapman at right.



DEEP EXPLORATION DRILLING: holes of these five rigs will be Gamma logged as described in article. Some diamond drill cores will be taken and check assayed.

How To Read, Record, and Evaluate Gamma Log Results

1. When a hole is probed, the recorder produces a log where the vertical scale represents depth of the hole and the horizontal scale is dependent on the sensitivity setting of the recorder.



2. Expanded log through the ore horizon, where one inch on vertical scale equals one foot of hole, is reproduced at the left. Horizontal sensitivity scale is 5.0 milleroentgens per hour.

3. Choose top and bottom of ore limits, measure area inside log curve with planimeter, and divide area by thickness in feet. This gives weighted average intensity in milleroentgens per hour. This is divided by 10 to give average ore grade in percent *e* U_3O_8. For this hole these calculations show 0.273 percent *e* U_3O_8.

4. An evaluation summary sheet for the same drill hole is shown below. Core recovery, 100 percent, is entered in last column. The radiometric core assays for each 1.0 foot of core are entered. Their weighted average is 0.286 percent *e* U_3O_8. Chemical assays for the same core sections are entered. This average is 0.364 percent U_3O_8. Difference is due to ratio of radiometric to chemical and must be constantly checked to insure accuracy.

4

CHAPMAN AND WOOD
DRILL HOLE EVALUATION SUMMARY

DRILLED BY Farris — LOCATION Section 32, T.14N., R.9W.
LOGGED BY P. G. Woods, Jr. — McKinley Co., N.M. Ls. No. 60-169
TITLE Geologist — DRILL HOLE NO. Y10+100N+100E
COLLAR ELEV. 6927' TOT. DEPTH — DATE STARTED 2/16/56
CORE INTERVAL 3 — DATE COMPLETED 2/18/56

STRATIGRAPHY	LITHOLOGY	MINERALIZED INTERVAL	BARREL PROBE	GAMMA LOG	CORE ASSAY % (1 inch)	CORE ASSAY % (1 inch)	CORE RECOVERY %
Qal 0-75'	Lt. gray sand and silt	560-561			161	225	
		561-562			247	339	
		562-563			.125	116	
		563-564			.476	639	
		564-565			.360	.416	100
Km 75'-245'	Dk. gray shale with interbedded lt. gray sand	565-566			196	230	
		566-567			131	.135	
		567-568			.570	761	
		568-569			.311	412	
Kd 245'-310'	White fine to coarse sand. Gray with coal at 280-310.	560.9 - 569.9		.273			
Jmbb	Gray-green ms. with lt. greenish gray fine to very coarse sand						
	at 370-390, 425-440, and at 455-470.						
Jmwc	Lt. gray med. to coarse grained sand. Greenish-gray siltstone						
	at 538-540. Asphaltic at 577-585.						
Jmrc 620-650	Variegated gray-green & maroon ms.	9.0		.273	.286	.364	

VALUE: Thickness: 9.0 feet
Grade: .364% Chemical U_3O_8

APPROVED: John A. Wood

had been unreliable and that grades were sub-commercial. Leases on the claims had been dropped by the company.

Over-Evaluation Catastrophic

At Ambrosia Lake such an over-evaluation would be more than unfortunate, it would be catastrophic. In this district land holdings favorable for exploration generally vary in size from one to a number of sections. Drilling depths vary from the 350 feet at the initial discovery point to as much as 2,000 feet, probably averaging about 700 feet. Most of the area still to be drilled is in the deeper category.

Even though the lithologic conditions permit comparatively low drilling costs and the size of known ore bodies presents a comparatively large sized target, adequate exploration of the areas involved is very expensive. To drill a single section to a depth of 700 feet on a grid pattern on 400-foot centers requires 169 holes totalling 118,300 feet. If significant mineralization is encountered, the area of interest must be further explored by closer order drilling and finally developed by a pattern on 100- to 150-foot centers. The direct drilling costs for such a program on one section might well fall between $500,000 and $1,000,000.

In the preliminary, or wildcat exploration phase of such a program, the speed and lower cost of open hole drilling are obviously preferable to slower more costly coring. In the development drilling stage a high percentage of cored holes becomes essential both to serve as a conclusive check on interpretation of radiometric results and to provide samples for metallurgical amenability tests.

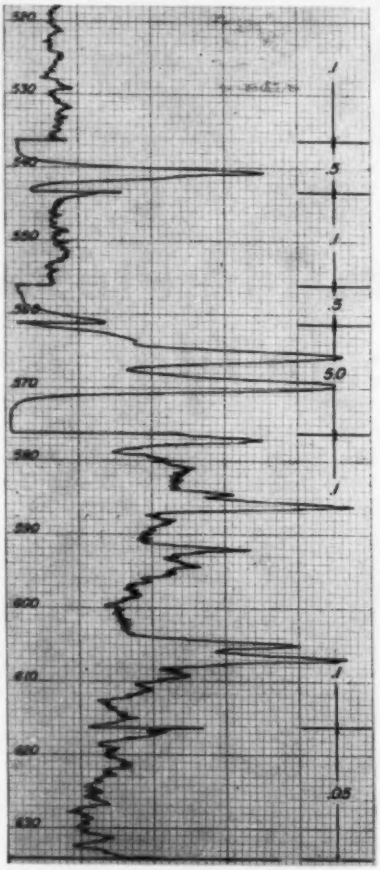
Radiometric Logging

The radiometric logging of drill holes is a subject which merits a separate article or a comprehensive panel discussion. Instrumentation, calibration techniques, and methods of interpretation vary widely. There is no doubt that the scintillation probing unit is one of our most valuable tools in exploration for uranium. It can give not only a most helpful picture of the lithological character of the stratigraphic column penetrated, but also, if properly calibrated and correlated to cored holes, a reasonably accurate indication of ore thickness and grade. There are many excellent gamma logging units in use. This is a brief description of the instrument which we have been using at Ambrosia Lake and other districts for the past 20 months and a summary, with the aid of pictures and reproduced logs, of what it can do.

A Moran SLMR 1000 Gamma Logger with a Welltab recorder is used. The unit is mounted in a Chevrolet station wagon and can be readily installed in a Jeep station wagon. Both the electronic unit and the motor driven reel operate on the vehicle's 12-volt, dc battery-generator system.

The unit is field calibrated with a radioactive calibration ring placed at the most sensitive point on the probe. The proper value for the ring for equilibrium calibration is predetermined by placing the probe in a calibration tub containing ore of known radiometric content, setting the recorder to the *e* U_3O_8 assay and observing the reading when the ring is in its proper position. This value is constantly checked by probing holes from which core has been taken for radiometric and chemical assay.

When a hole is probed, the recorder produces a log on which the vertical scale is one inch to 10 feet and the horizontal scale is dependent upon the sensitivity setting used. A portion of the log for one Ambrosia Lake hole is reproduced here. Four of the six available sensitivities appear on this log: 0.05, 0.1, 0.5 and 5.0 milleroentgens per hour. In each case the numerical designation represents the top scale reading in milleroentgens per hour for that particular setting. When properly calibrated, milleroentgens per hour divided by 10 is equal to percent *e* U_3O_8. In this hole the log shows mineralization extending over 69 feet from 540 to 609 feet. Nine feet, from 561 to 570, would be classed as ore.



MULTI-SCALE GAMMA LOG with sensitivities at right. Radioactive formations are logged on an enlarged scale for greater accuracy. The ore section between 561 and 571 feet was re-logged as shown in log on page 48.

A valuable aid in evaluation of ore thickness and grade is the use of an expanded log through the ore horizon with a vertical scale in which one inch represents one foot. Ore values are calculated by choosing top and bottom ore limits, measuring the area inside the log curve with a planimeter, and dividing the area by the thickness in feet. This gives a weighted average intensity in milleroentgens per hour which, divided by 10, represents average grade of the ore zone in percent *e* U_3O_8. For this hole these calculations show 9.0 feet at 0.273 percent *e* U_3O_8.

An evaluation summary sheet for this same drill hole is shown. Core recovery was 100 percent; radiometric core assays show 9.0 feet at 0.286 percent *e* U_3O_8 and chemical assays, 9 feet at 0.364 percent U_3O_8.

The drill hole which has been used as an illustration is one of 66 in one ore body for which both gamma log evaluation and core assays were made. Weighted averages for all of these holes were:

Gamma Log 5.05 Feet at 0.254 percent *e* U_3O_8.

Core 4.96 Feet

Radiometric Assay: 0.218 percent *e* U_3O_8.

Chemical Assay: 0.304 percent U_3O_8.

Such checks are within a very satisfactory range of accuracy and with careful work are the rule rather than the exception. However, it must be remembered that the radiometric to chemical ratio varies widely from district to district, from ore body to ore body within a district and even from hole to hole within an ore body. Constant checking is esssential if we are to avoid the sad experience, cited earlier, of the company which mined the ore body which was not there.

The present trend in exploration for uranium is toward deeper and deeper drilling, resulting in higher and higher costs. It is only common sense under such conditions to utilize the best quality you can obtain in equipment, in instruments, and in evaluation techniques.

THE END

PEGMATITE MINING takes lots of hand labor. These natives are carefully sacking mica and associated beryl at one of the Tantalite Valley mines. Workings carefully follow the higher grade beryl-muscovite zone.

Tips For Pegmatite Prospectors and Miners By South African Geologist

By PETER WEIDNER

Pegmatite mining has expanded on a world-wide basis to meet the recent demands for columbite and tantalite which resulted in a United States government buying program. So successful was the program that it has recently been terminated ahead of schedule. Operators like Mr. Weidner are typical of the many small miners who filled the stockpile quotas. In commenting on this article he has drawn from his many years of pegmatite mining and has said: "There are so many aspects to be considered that one could easily write a book about pegmatites and pegmatite mining. Believe me, an operator should take a course in Economics as well. One can very easily go broke, more so on pegmatite mining than any other."—Ed.

Mr. Weidner is manager of Tantalite Valley Minerals (Pty.) Ltd., Warmbad, South West Africa.

Much has been learned about pegmatites and pegmatite mining in the last 15 years. Geologists have led the way with detailed mapping of structure and zoning in pegmatite areas in all parts of the world. In the Warmbad district of South West Africa,[1] the latest geological theories have complemented experience gained from actual mining operations on a number of pegmatites. It is most important that for pegmatite mining the following question must be first asked.

Where Are Best Pegmatites

By "best" is meant those bodies which are likely to give the operator the best return. In the Warmbad district alone there must be several thousands of pegmatite bodies ranging in size from small superficial stringers to immense massive bodies many thousands of tons in extent. When does the prospector of experience know whether he has arrived at a spot more favorable for investigation than others in the surrounding neighborhood?

It is the writer's firm belief, based on experience, that pegmatites near, or at the contact of, two types of rock-bands running parallel to each other are the pegmatites where the prospector should make a thorough investigation.

[1] *Concepts of the Internal Structure of Granitic Pegmatites and Their Applications to Certain Pegmatites of South West Africa,* Transactions of the Geological Society of South Africa, 1955, Eugene N. Cameron.
Economic Importance of Pegmatites, B. Booysen, Deputy Inspector of Mines, Windhook, South West Africa

As an illustration, take the Tantalite Valley pegmatites which are located on the right hand side of the long snakelike track in the top center of the Tantalite Valley picture. Here the host rock is amphibolite and diorite. On the opposite side of the Valley, i.e., on the left hand side of the track, the pegmatites are in granitic gneiss. Mining in the last seven years proves, without any doubt whatsoever, that the amphibolite-diorite side is infinitely better mineralized than those pegmatites which are located in the gneiss band. We have learned to continue to work the pegmatites on the right side, to rob the surface of those bodies which have been found on the other, and then pass on.

The question will now be asked, "Where is your evidence that your theory is correct?" At Tantalite Valley, there are two types of laborers. The "A" gang is made up of the cleverer boys (natives) who work on "tribute," i.e., they are paid for production. The "B" gang is made up of daily paid wage earners. Slowly through the years, the tribute workers who are allowed to wander at will over the claims have mapped out the area held under mining lease. Whereas the workings on the amphibolite-diorite side have slowly expanded and the workings have become bigger and deeper, those pegmatites on the opposite side of the valley have slowly been ignored until today they are being avoided altogether.

Another interesting fact about these two areas is that tantalite is an accessory in the first named area and columbite is recovered from the other.

If the pegmatite to be examined is located on the side or near the top of a hill, the prospector should commence his investigation at the bottom of the hill under the pegmatite. As he ascends, he should keep his eyes open for any mineral float, i.e., beryl, tantalite, columbite, bismuth, or one of the lithium minerals. It is during this prospecting, either through incompetence or laziness, that some men have missed small fortunes because they were not methodical enough in their work.

How To Rob the Surface

Here is the story of the Tantalite Valley alluvial deposit (Block No. 2, Placer No. 1) where tantalite and bismuth concentrates were recovered from the dry river bed running alongside the track seen in the Tantalite Valley picture.

a) The labor employed consisted of six adult men, three youths, and four women (all of the Hottentot tribe known as Bondelswarts). These natives between them operated trolleys, trommels, screens, and a Pleitz diamond jig washing machine. No mechanical power was used.

b) Gravel was taken to the washing machine station in cars on track laid in the river bed.

c) Four drums of water (160 gallons) were required for one day's operation, depending on the mesh and size of the gravel to be washed.

d) About 8,000 pounds of sifted gravel through the machine would be a good day's performance. The size of the material ranged from pinhead to ½-inch. Any coarser gravel was sorted at the screens because it is easily recognized.

e) Recovery per shift (i.e., from sunrise to sunset) averaged out at 14 pounds of tantalite and from four to six pounds of bismuth, i.e., a recovery of from 18 to 20 pounds of concentrates each day.

f) Roughly estimated, the recovery amounted to 0.25 percent (two concentrates).

g) Operating costs per day: Labor £3 16s 0d plus water 10s gives total expenditure of £4 6s.

h) Market value of concentrates recovered each working day £26 0s 0d (approximate).

i) Profit per shift £21 14s.

TANTALITE VALLEY, South West Africa. Pegmatites in the valley at top right have economic concentrations of beryl and columbite-tantalite. The author points out that these pegmatites are along contact between two different rock types.

SCREENING IS FIRST STEP for recovering alluvial tantalite, columbite, and bismuth. Carefully sized material is then fed to a hand operated jig where a high-grade mixed concentrate is produced.

j) Total value of concentrates sold which were recovered from this dry river bed exceeded £7,000. Of course to a big company £7,000 in earnings does not sound wonderful, but many thousands of small businessmen or clerks in an office would be very happy with a daily profit of £21.

k) Interesting as our mode of recovery may have been, perhaps the most interesting operation of of all was the separation of fine bismuth from fine tantalite. Both minerals have very much the same specific gravity; thus, it would not be possible to separate them by jigging. The best that can be said for them is their colors are easily recognized.

This fine material, i.e., "pinhead" and minus-pinhead-mesh, was sent to a nearby mission school where the small children with their patient little fingers and keen eyesight diligently separated the yellow bismuth from the black tantalite. Each child was able to separate from ¼ to ½ pound per day for which he or she was paid at the rate of 4s per pound.

Potential Paying Pegmatites

The reader will, by now, be satisfied that fortunes are not made overnight. True, an operator can sometimes make easy money by robbing the surface of what concentrates he can find and moving on. But, as the saying goes, "Rolling stones gather no moss." Sooner or later there are no more surfaces to be robbed; besides, a man who hops from one place to another without knowing what he wants very rarely accumulates a fortune.

DIAMOND DRILLING is used at Tantalite Valley to check the location of zones, not grade, ahead of workings.

Returning then to the conscientious operator. Having robbed the surface in the manner described, he will commence looking for further indications of mineralization in the pegmatite itself. He has already had the proof that the pegmatite is mineralized but he has now to determine where to start mining. The writer was very fortunate to learn "stalking" from Dr. Eugene N. Cameron, University of Wisconsin. Dr. Cameron is an authority on pegmatites and pegmatite minerals and his publications are strongly recommended to those students who are interested in this new type of mining.

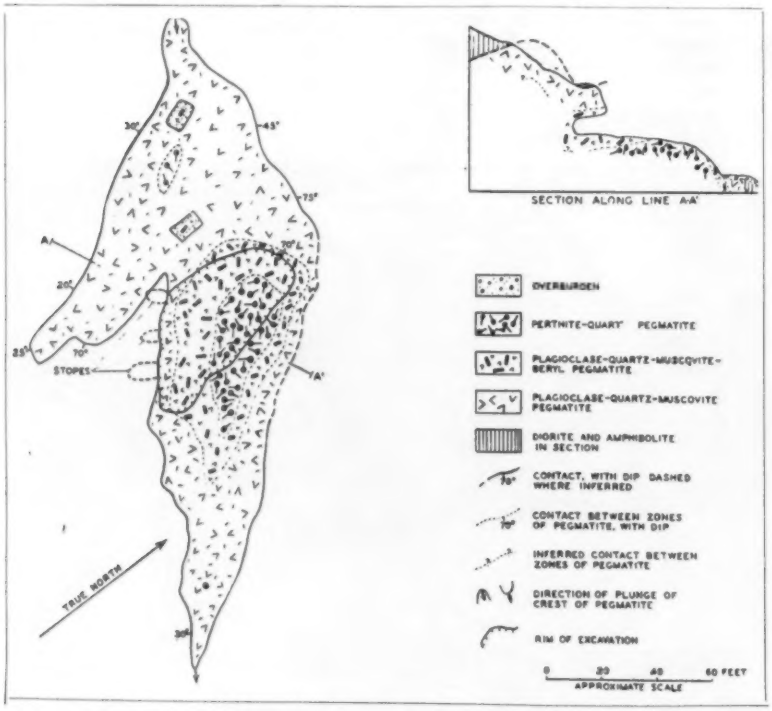
The first thing Dr. Cameron would do when commencing his investigation would be to go down on all fours in an endeavor to see the first speck of beryl. It may be a crystal as small as a trouser button or a trace of one of the other associated minerals. Each discovery will be covered by a small piece of note paper covered again by a small pebble (to keep the paper in position). Painstakingly, he will cover the area, and then begin establishing whether the pegmatite goes down to depth or is lying on its side; finally, he will determine the zones. It is not necessary for the writer to attempt to explain zoning to the interested reader; however, I would recommend the reading of *Internal Structure of Granitic Pegmatites* by Cameron, Jahns. and McMair. On page 107 the authors write:

"The clues for successful recovery can only be detected by applying a broad knowledge of pegmatite structure and mineral distribution and by careful study and correlation of internal structures and lithologic sequences in the various pegmatites within a given district. If this is done it seems likely that the range of successful prospecting can be extended beyond the limits imposed by the practices of the past."

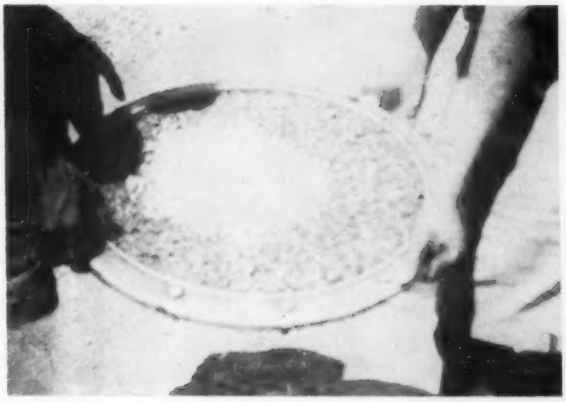
Many are the changes therefore that have come about since 1935 when in Memoir 31, Department of Geology, Union of South Africa, *The Pegmatite Area South of the Orange River in Namaqualand*, Gewers, Partridge, and Joubert claimed on page 137 that:

"Although a considerable number of different minerals are known to occur in the pegmatites of Namaqualand and quite a number of occurrences are highly interesting from a mineralogical point of view, not one occurrence was seen in which several of these minerals were present in sufficient quantity to justify the hope of their combined recovery being payable. There would also appear to be little reason for expecting such favorable combination to occur in depth."

Those then were the views on pegmatites of geologists the world over



PLAN, SECTION, MINERALOGY of pegmatite showing zoning. *Transactions of the the Geological Society of South Africa, 1955.*



CONCENTRATE collects on the bottom of the jig bed. Note the sharp separation between the yellow bismuth and the black tatalite. "Pin head" fines must be hand separated.

ALLUVIAL TANTALITE-BISMUTH mine and washing plant. Water is a scarce commodity and is hauled to the small hand operated jig.

in the period preceding World War II. From the experience gained since, it would appear that the authors of early writings on pegmatites, i.e., prior to the War, were inclined to judge mineralized pegmatites by the yardstick used for other minerals occurring in veins; because a case for veins and continuity could not be worked out *by them*, it was concluded: "The mineral occurrences the world over were highly erratic and patchy in nature, and consequently not worth worrying about."

It is most unfortunate for the country's finances that this view still exists in South and South West Africa today.

South Africa, together with the other gold producing countries, is repeatedly agitating for a higher price for gold. The United States quite unconcernedly and calmly replies: "Nobody is forcing you to produce gold and if you cannot come out on the price we are prepared to pay, why go on producing it?" *But*, adds: "Give us the minerals of which we are in short supply, and we would be very pleased to negotiate."

As proof let me make a few comparisons of pegmatite mineral prices:

Mineral	*Price March 1956*	*Price June 1950*
Beryl	260s per long ton unit	160s
Bismuth	9s per pound Bi (content)	8s
Columbite	215s (basis 70 percent Cb)	130s
Tantalite	£4,200 ton (70% Ta_2O_5)	£910

Facts cannot lie and the above figures are a clear pointer that the demand for pegmatite minerals has come to stay. Prospectors and others are, therefore, allowing a golden opportunity to slip through their fingers by their continued disinterestedness.

Financial Requirements

It is not considered likely that any big finance company or mining house would become interested in pegmatite mining because these bodies are too sparsely mineralized and scattered. In other words, big companies are not interested in ventures other than "mass mining." The answer is, I believe, to be found by the formation of syndicates, each with a capital of say between £20,000 and £30,000; the method of recovery to be employed should be by "selective mining."

Each syndicate will, of course, accumulate a fair percentage of low-grade ore which would have to be mechanically handled. It is suggested, therefore, that a plant ultimately be erected at some suitable central spot which could treat the ores coming in from the prospects in the area.

Investors in South Africa would hardly show much interest in syndicates, and would not be prepared to patronize back street "fish shops," thanks to being spoiled by the glamor of gold and diamonds. They couldn't possibly back anything smaller than a "whale factory."

Lagging Behind

It would appear to be correct what the authors of *Granitic Pegmatites* have stated (page 106):

"It must be admitted that the geological profession has lagged behind the mining industry in realizing that pegmatite mineral distribution is far from being haphazard. Anyone who studies and maps the workings of pegmatite mines in detail is readily convinced that the concentration of minerals into paystreaks, zones, columns, shoots, and the like has been known to the more intelligent and experienced miners for decades."

PEGMATITE OUTCROPS are carefully cleaned off first so that study of the structure and zoning can be made before mining is started. Then open cuts follow the zones. Barren feldspar and quartz are trammed to dump in foreground.

CALERA is the largest United States cobalt producer. Ore is mined and milled at the Blackbird mine at Cobalt, Idaho. Concentrates are shipped to this refinery at Garfield, Utah where cobalt granules are produced by new process.

How Calera Solved Metallurgical Problems at Garfield Cobalt Plant

By J. S. Mitchell

If it wasn't for titanium metal the cobalt refinery of the Calera Mining Company at Garfield, Utah wouldn't be in successful operation at this time. Of the scores of metals, ceramics, and other materials from gold to zirconium tested to overcome corrosion, temperature, pressure, and abrasion problems, titanium has been the most successful.

Since December 1955 the plant has been operating successfully under Calera's management.

The plant was designed and built to use a new process developed by the Chemical Construction Corporation. Unusual and difficult mechanical problems had to be overcome before the plant operated successfully. Chemico, Battelle Memorial Institute, and Calera's parent company—Howe Sound Company all worked to overcome these difficulties. It took time and it took money and the plant is operating successfully today.

Blackbird Concentrate

The concentrate arrives at the refinery from Calera's Blackbird mine at Cobalt, Idaho in railroad boxcars in approximately 50 ton lots. Average analysis of concentrate and refined metal appears in the table. Concentrate is removed from the cars with mechanical loaders and temporarily stored in individual bins pending subsequent blending and introduction to the plant system. Each carload lot maintains its identity up to the time that it is charged to the concentrate mix tank.

Based on the arsenic and iron content the concentrate is blended to achieve a ratio of approximately 1.20 arsenic to 1.00 iron. This ratio is an important factor in achieving the optimum chemistry in the oxidation autoclave.

The concentrate is repulped with process water or dilute process liquors to a pulp density of approximately 25 to 27 percent solids.

For all practical purposes the subsequent handling of this slurry is achieved with conventional agitation and pumping equipment. In transferring the slurry from the initial repulping tanks to storage feed tanks it is passed over a vibrating screen for the removal of debris and oversize that may interfere with subsequent pumping.

Pressure Oxidation

Oxidation is carried out in a horizontal pressure vessel 40 feet in length and 6 feet in diameter. The shell is of carbon steel with a $\frac{3}{16}$ inch cladding of type 316 stainless steel. In addition to the cladding, the vessel has a 12 pound lead lining and acid brick.

The lead lining is an additional safeguarding feature, installed at the time the first acid brick lining was replaced after approximately three years service. Inspection of the stainless cladding after the failure of the initial acid brick lining revealed that in spite of the precautions taken, it had been attacked to a considerable degree.

The autoclave is divided into six equal compartments by acid brick walls. These walls have overflow weirs at their upper extremities thus allowing the oxidation slurry to flow from one compartment to the other. Each compartment contains an agitator mechanism to provide mixing and aeration. Provisions are also made to sparge air into each compartment.

Concentrate slurry is introduced to the first compartment by means of Manton-Baulin high pressure positive displacement pumps. The original pumps were triplex plunger type. Severe abrasion and corrosion resulted in extremely high maintenance costs; consequently, these units were replaced with Manton-Gaulin "Hydrex" pumps. These are newly developed hydraulic displacement type and are

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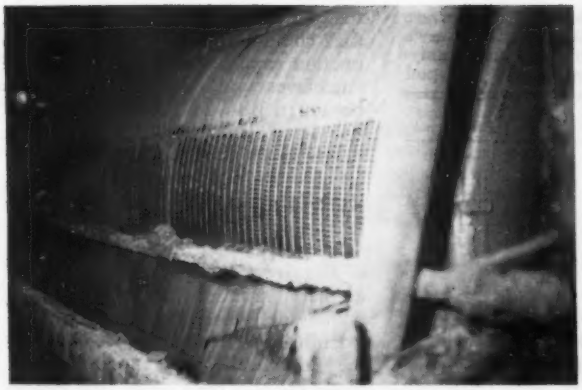
Mr. Mitchell is plant manager of Calera Mining Company's Garfield, Utah cobalt refinery. This is a condensation of Mr. Mitchell's paper on the Garfield refinery presented before the Rocky Mountain Minerals Conference in Salt Lake City, Utah.



FILTERING OXIDATION SLURRY is done on this special stainless steel drum filter with hard rubber decks. Filter cloth is polyethylene. Cake is iron arsenate-gypsum residue.

HYDROGEN REDUCTION is carried out in these vertical autoclaves. The charge and discharge pipes at right are 316 stainless steel. Pressure is 800 pounds per square inch.

giving acceptable service at this time.

Addition of concentrate, process solutions, recycled process slurries, and the discharge of the oxidized slurry is a continuous operation. Operating level is controlled by a "Gagetron."

The chemical reaction is exothermic, producing an oxidation slurry containing free acid, cobalt, nickel, iron, and copper as sulphates and minor amounts of arsenic in solution, also iron-arsenate and calcium sulfate as an insoluble residue. Operating pressures are maintained at over 500 pounds per square inch and temperatures in the various compartments are over 375° F.

The exit gas from the autoclave (oxygen deficient air and steam) is exhausted thru scrubber towers to the atmosphere. Oxygen utilization from the compressed air introduced to the reactor approximates 60 percent.

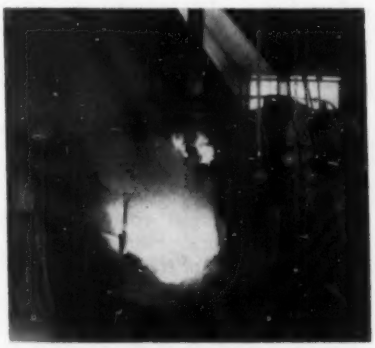
The oxidation process solubilizes 95 to 97 percent of the cobalt. However, there are small losses of soluble cobalt in the subsequent filtration step.

The acid slurry discharge from the oxidation autoclave is substantially neutralized by the addition of limestone and hydrated lime. Some precaution is necessary at this step in order to avoid precipitation of cobalt hydroxide. Formation of this compound would result in its loss with the insoluble iron aresenate–gypsum residue that is discarded to waste in subsequent filtering operations.

Filtering of the oxidation slurry is achieved on conventional drum filters fitted with stainless steel drums and hard rubber decks. Polyethylene filter cloths are used on all drum filters. The usual procedures of repulping, refiltering and displacement washing are carried out, so as to reduce soluble losses to a minimum. Dilution of the primary filtrate is controlled to a cobalt concentration appropriate to the subsequent reduction operation.

Further purification of the process solution is necessary in order to remove the residual iron (that amount that was in excess of the stoichiometric requirements to form iron-arsenate in the oxidation autoclave), arsenic and copper. The iron and arsenic are removed conventionally by addition of hydrated lime, anhydrous ammonia, and air. This process is a batch operation carried out in steam-heated rubber lined tanks. Proper aeration and temperatures of approximately 140° F. are considered essential. The above procedure produces a residue of gypsum, iron hydroxide, and minor amounts of iron-arsenate. The resulting slurry is filtered on precoated drum filters to give an iron and arsenic-free solution. The residue is recycled to the oxidation autoclave since it contains appreciable cobalt values. The filtrate is advanced to a subsequent batch process wherein the copper is removed by simple cementation with cobalt powder.

The cementation step produced some unexpected results. In order to attain an acceptable time cycle for this operation it was necessary to introduce excess amounts of cobalt powder. This quite naturally produced a copper cement sludge that contained appreciable percentages of cobalt. This represented a "tie-up," as well as a copper cement that was not marketable. However, a process has now been developed whereby these cements have been retreated, yielding the copper and cobalt as separate products.



SULPHUR REMOVAL from powdered metal is done in this Electromelt furnace which reaches 2,800° F. temperature.

Hydrogen Reduction

The reduction step is a batch process carried out in vertical autoclaves of approximately 450 gallons capacity each. These vessels are fitted with agitators, hydrogen spargers, and steam jackets.

The purified solution produced in the previously mentioned steps is now ready for the production process. Anhydrous ammonia is added in controlled amounts to produce a complex cobalt ammine. The resulting solution is pumped into the reduction autoclaves, heated to approximately 375° F., compressed hydrogen is admitted, and in the presence of a catalyst, the cobalt is reduced to a fine metal powder, grey in color with an apparent density of 4 to 5. The total operating pressure is 750 to 800 pounds per square inch.

An operating cycle consists of a "seed run" and several "densifications." In the "seed run" the formation of the metal powder is a result of the "catalyst," which produces a fine metal powder. In the subsequent "densification" runs the powder from the "seed run" acts as the nucleus to produce powder of increased particle size and density, depending on the number of densifications.

A problem encountered in the reduction step was the production of cobalt metal powder that contained

excessive sulphur impurity. This sulphur is present as entrapped gypsum particles and to some extent in contained ammonium sulphate. The latter can be removed in part by successive displacement water washes and subsequent decantation or filtration.

Initial process design had called for calcining the powder in a hydrogen atmosphere followed by compacting in a conventional pelletizing press. Since the powder did not meet sulphur specifications a further refining step became necessary before a saleable final product could be produced. This problem was solved by the installation of an arc furnace.

The fact that the gaseous reduction step did not produce complete conversion of the cobalt content of the feed solutions to metallic powder presented another unexpected problem, with accompanying loss of metal. Conversion is in the neighborhood of 97 to 98 percent. It was also discovered that some redissolution is experienced if the metal powder is allowed to remain in contact with the reduction end liquors.

Therefore, the reduction and liquors and wash water are now treated with ammonium, or sodium sulfide, to produce a cobalt sulfide precipitate, which is filtered out, and subsequently returned to the oxidation step.

Arc Furnace

The powdered metal produced in the reduction step contains on the average 0.15 percent sulphur. It is charged into a size "Q" Lectromelt furnace and melted down in the presence of a high lime slag. Minor amounts of coke are added, and some pig aluminum for degassing the metal is charged just prior to the pour.

Pours are made as soon as a sulphur analysis indicates that the metal is within specifications. By this time the bath has reached a temperature of approximately 2,800° F. The molten metal is poured into a pit of water in order to form granules. Temperature and rate of pour have a decided effect on the physical characteristics of the final product.

Operational Problems

In brief, the metallurgical process has been outlined. However, mechanical difficulties presented many problems.

To the uninitiated, the process seems quite straightforward. As far as flow of material is concerned, this is true. The problem of containing the process was another matter. During the early stages of development many difficulties were encountered in the mechanical operation of the oxidation autoclave. Gasket and valve failures were frequent, also packing life of the agitator shafts was of short duration. Prior to acquiring titanium bolts and fasteners (at the time under development and of long delivery) the agitator impellers would fall off at the rate of one per week. At this point, it might be mentioned, that the corrosion resistance of even the best stainless steels against the hot slurry is almost nil.

Analysis of Blackbird Concentrate Feed to Calera Mining Company's Garfield Cobalt Refinery, and Analysis of Cobalt Granules As Shipped

Constituent	*Percent In Feed*	*Percent In Granules*
Cobalt	17.50	95.60
Iron	20.00	0.20
Arsenic	24.00	0.03
Sulphur	29.00	0.03
Nickel	1.00	3.90
Copper	0.50	0.02
Insoluble	5.00	—
Moisture	12.00	—
Carbon	—	0.15

Gas let-down from the vessel (operating pressure to atmospheric) took its toll in various alloy valves. Stainless steel valves, fittings and fastenings literally dissolved under the severe operating conditions of both erosion and corrosion, and service life was short.

After many months of "cut and try" with design and materials of construction, these items were improved to a considerable degree. In most all instances these critical parts have had to be developed and then fabricated locally. Until recently no suitable substitute had been discovered for the titanium and ceramic that went into the slurry and gas discharge valves. Importance of titanium for agitators and discharge piping cannot be overstressed. More recently it has been found that tantalum, Refrax R, and silicon carbides have promise for these applications.

The mechanics of the gaseous reduction phase appear to be rather simple from an operating standpoint. One might say that the combination of pregnant solution, catalyst, and a controlled hydrogen atmosphere produces cobalt powder. This is all very well, but it does not account for the considerable percentage of cobalt metal that ends up as a dense metallic plating on the interior surfaces of the reduction autoclaves. Extensive research in the field of agitation, catalysts, and chemical composition of working solutions resulted in decreased amounts of this plating; however, the condition continues to exist.

When these deposits were first encountered they were removed by manually chipping with pneumatic hammers. This was costly, laborious, and time consuming. However, this method was the only practical way that could be used at the time. Reduction capacity was limited to four autoclaves and "down-time" had to be minimized. In the interim, additional autoclaves were acquired which provided increased capacity, making feasible the development of an "acid leach" for removing the plated deposit.

To add to the problem, the removal of the deposit by chipping produced a platy product (several thousand pounds per vessel) that required considerable treatment before it could be recycled to the plant flow. A technique has now been developed whereby the material has been converted to a remarkable product.

Mechanical Weaknesses

Added to the mentioned process problems were mechanical weaknesses. Agitator mechanisms were a recurring source of operating delay, partly because of repeated failure of packing glands. Discharge valves also failed frequently as a result of erosion experienced in handling the powdered metal slurry while taking a pressure drop of some 800 pounds per square inch. Gasket failures were almost an everyday experience.

Initially the autoclaves were fitted with internal steam coils. These coils often failed at the welds, resulting in contamination of condensate and presenting further problems in the steam plant. Even the operation of a relatively simple steam trap became a problem when cobalt bearing solutions found their way into the system. However, during their period of operation, Chemico replaced the heating coils with external steam jackets, which have eliminated this particular problem.

Electrolytic Refining Ahead

The Garfield Refinery, being the first such plant of its kind to be put into production presented many new and difficult problems. In a period of three and one-half years many of these have been solved, while others remain to be improved to a considerable extent.

Development work continues in an effort to simplify the various phases of the process. At this time, much is being done toward replacing batch operations with continuous flow.

Work has already started on a plant addition for the electrolytic refining of cobalt. This will produce a higher grade product at lower cost and eliminate the hydrogen reduction, and arc furnacing steps now being used. This unit is scheduled for operation in late 1957.

THE END

What Do Miners Want From Government?

What does the western mining industry need to maintain a healthy active going state? No one knows all the answers but representatives from the leading mining companies in the western states pooled their thoughts as to what was needed in late April at a meeting in Reno, Nevada. The meeting was the Western Governors Mining Advisory Council which made recommendations for action to the Western Governors Conference. The Governors conference then formulated its recommendations for the mining industry and forwarded them to the Congress of the United States and appropriate branches of the Executive Department.

It is the hope of the Council that these recommendations will be appropriate and useful in formulating the Administration's long promised Long Range Minerals Policy.

The western governors appointed delegates to the Council meeting which preceeded the Conference. From these delegates, mineral committee chairmen were picked to formulate recommendations for each mineral. The council then voted, by states, on the recommendations to be delivered to the Governors Conference.

The Governors Recommended

Key mineral resolutions adopted by the nine western governors at the meeting were:

"The time has now come that it is imperative that temporary programs be replaced by sound, long-range programs that will provide a climate conducive to attaining a permanent stability in the minerals industry.

"The Western governors agree that the necessary program can best be expressed in some form of protection for the domestic minerals industry against the differentials in the economic structures of various world producers of minerals; notably the differential between the wage scale in this country, which we wish to maintain, and that of many foreign areas; and that effective steps should be taken to prevent this country becoming a dumping ground for cheap foreign production, and to permit the domestic minerals industry to operate on a basis of normal supply and demand, with only the amount of protection needed to adjust the differentials previously referred to.

"The barter program must be continued and expanded to include all minerals and metals needing such aid and suitable for stockpiling, until such time, not too long delayed, as an equitable and effective long-range minerals policy, based on reasonable and effective import control measures, can be formulated and put into effect.

The Council Recommends

Mineral committee chairmen and the key recommendations of their committees for metals and minerals were:

ANTIMONY, James P. Bradley, Bradley Mining Co.

"Minimum tariff or excise rates be established on antimony ore and concentrates at not less than 15 cents per pound of contained antimony; and on antimony smelter products at not less than 30 cents per pound of contained antimony."

CHROME, Hollis Dole, Oregon Department of Mineral Resources, and J. R. Holman, California chromite producer.

"An excise tax equal to ¾ cent per pound on contained chromium metal in imported chromite ore be established. Proceeds of this tax to be allocated, pro rata, to the producers for chrome mined and sold in the United States."

COBALT, E. B. Douglas, Calera Mining Company.

"The General Services Administration be directed to enter long term purchase contracts with domestic producers at a floor price of not less than $2.35 a pound."

COLUMBIUM-TANTALUM, Robert Porter, Porter Brothers Corporation.

"The government continue the domestic purchase program for columbium-tantalum, and expand it to include euxenite and/or samarskite which are found in combination with the aforementioned metals."

COPPER, J. B. Pullen, Phelps Dodge Corporation.

"The copper excise tax peril point (24 cents per pound) and the excise tax (2 cents per pound) be examined in order to determine whether the American producer is being reasonably protected."

GOLD, L. I. Huelsdonk, Best Mines Company, and SILVER, Tom Lyon, consulting engineer.

"Congress enact legislation to abolish the present restrictions on the purchase, ownership and sale of gold and silver, and to restore the traditional rights of the citizens to freely possess, process, buy and sell these precious metals.

"To ensure a sound currency, the Treasury should continue to purchase all newly mined domestic gold and silver tendered.

"Neither gold nor silver be sold by the Treasury from its present stocks, or from future acquisitions, for other than monetary purposes. This restriction is necessary to the preservation and strength of our monetary system."

LEAD and ZINC, Miles Romney, Utah Mining Association.

"An excise tax of 2 cents per pound be established on imports of zinc and lead to take effect whenever the price of zinc falls below 14 cents, East St. Louis, and the price of lead below 16 cents, New York. The present stockpiling of lead and zinc should be continued until such an excise tax is put into effect."

MANGANESE, F. A. McGonigle, Manganese, Inc.

"A tariff be established of 7 cents per pound of contained manganese in imported foreign ores. If this is impossible, then a tariff or excise tax equivalent to one-half cent per pound of contained manganese be imposed, the proceeds being distributed to domestic producers on the basis of each domestic producer's unit production produced and sold. The limitation of 10,000 tons on the carlot program be eliminated until the provisions above are adopted.

MERCURY, Gordon I. Gould, Gordon I. Gould and Company.

"The establishment of an excise tax of $1.00 per pound on imports of quicksilver, to take effect whenever the price of quicksilver falls below $250.00 per flask, New York."

PHOSPHATE, Lloyd Haight, J. R. Simplot Company.

"The Congress of the United States enact into law pending legislation which permits one lessee to hold up to 10,240 acres of federal land under lease from the United States irrespective of which state or territory the land under lease is located."

POTASH, A. J. Thompson, New Mexico Bureau of Mines .

"The domestic potash industry be provided adequate protection against dumping of foreign potash in the United States. Congress enact legislation providing for the automatic invocation of penalties against dumping whenever the government has reason to believe that an act of dumping is about to occur or is in process."

RARE EARTHS and THORIUM, Harold Bailey, Molybdenum Corporation of America.

"Conduct and encourage research in the utilization of rare earths.

"Either establish and publish an adequate purchasing program for thorium or declare it to be a freely marketable metal."

TUNGSTEN, Roy Hardy, Getchell Mines, Inc.

"An adequate duty or tariff of $1.60 per pound of contained tungsten be established to enable the domestic tungsten mining industry to stand on its own feet and compete with the low-cost foreign producers."

URANIUM and VANADIUM, Merritt Ruddock, Almar Minerals, and Mitch Melich, Uranium Reduction Company.

"It is urged the Commission re-appraise the fixed concentrate price periodically, taking into account increased production costs, in order that a stable and healthy industry be maintained.

"It is noted that the definition of a mining property, as it affects the 1,000,000 pound per property limitation, remains ambiguous, and should be clarified in a new AEC directive. Under existing conditions, many small operators in newly developed areas of Washington, Oregon, and Wyoming are unable to find a market for their ore."

. . . with K. E. Zachos, Director of the Greek Institute for Geology and Subsurface Research

Are There Mining Opportunities In Greece?

Q. Just what are you doing in the United States?
A. I am in the United States under an Eisenhower Exchange Fellowship to learn about geological organizations, mining operations, and ore deposits.

Q. How does the Eisenhower Exchange Fellowship operate?
A. Fellowships are awarded to the most promising individuals in the Free World. These individuals must have demonstrated their ability and achievement in the field of their country's greatest need. The Fellowships are not based on formal study, but do provide each recipient with practical day-to-day experience which will acquaint him with the United States and be of value to him as a leader in his own country. Potential leaders in the fields of greatest need in other nations are brought to the United States for first hand observation of developments in their fields. They were established in honor of President Eisenhower on a non-partisan basis for his contributions to humanity.

Q. How did you receive the Fellowship?
A. I was selected by important Greek citizens and the United States Ambassador to Greece. I did not apply for the Fellowship and was surprised when I was called for a preliminary interview.

Q. How are you using the Fellowship?
A. My intention is to see and study the exploration and mining work in the United States and obtain ideas and suggestions for finding more ore deposits and developing new mines in Greece. Also very important to me is to meet outstanding people from the mining business.

Q. Who are these important people?
A. Already I have met quite a lot of men, including Mr. Ankeney, director of the U. S. Bureau of Mines, and Mr. Nolan, director of the United States Geological Survey. At Anaconda I met the president, Mr. Weed, and the vice president and chief geologist, Mr. Perry. I also met Dr. Boyd, the vice president of Kennecott Copper Corporation, and the chief geologist from Union Carbide and Carbon Corporation, Mr. Frasché. From St. Joseph Lead Company, I met the vice president, Mr. Francis Cameron. Also many more outstanding gentlemen.

Q. How long will you be in the United States?
A. Until the end of September. I arrived in New York on March 8.

Q. What laboratories, geological departments, and mining districts will you visit?
A. I already have visited the Geological Survey and the Bureau of Mines and their laboratories. I will see the Bureau's experimental stations in Reno, Nevada; Denver, Colorado; and Albany, Oregon. I have seen Humphreys Gold Corporation's beach and mining in Florida. I will visit Anaconda Company's mines in Butte, Montana, as well as other mines in California, Colorado, Utah, and other places before my return in September.

Q. What United States mining companies are now active in Greece?
A. The Magnet Cove Barium Company which has formed a joint company called Mycobar Mining Company with the Greek firm of Myconos Mining Company S. A.; the Kennecott Copper Corporation which has secured a concession east of the famed Mt. Olympus covering a large area of serpentine in which long fiber asbestos deposits were found several years ago; Union Carbide and Carbon Company which has sent geologists to carefully check chromite deposits.

Q. What are the United States companies doing?
A. The Myconos Company is mining, crushing, and shipping barite ore to the United States. A complete new crushing plant and ship loading facilities were completed last year and first shipments made. Incidentally these deposits were originally worked unsuccessfully for their small silver content.

Kennecott Copper has a geologic and exploration crew at work. A systematic diamond drilling prospecting program is underway with holes being drilled on a regular grid to prove grade, tonnage, fiber characteristics, and shape of the deposit. Initial results have been favorable and it appears that Kennecott may build a several-thousand-ton-per-day mill. Fortunately the deposit can be mined by open pits.

Union Carbide geologists have left Greece. However, it is encouraging to note the recent increased interest in chromite and manganese with inquiries and geologists coming from abroad.

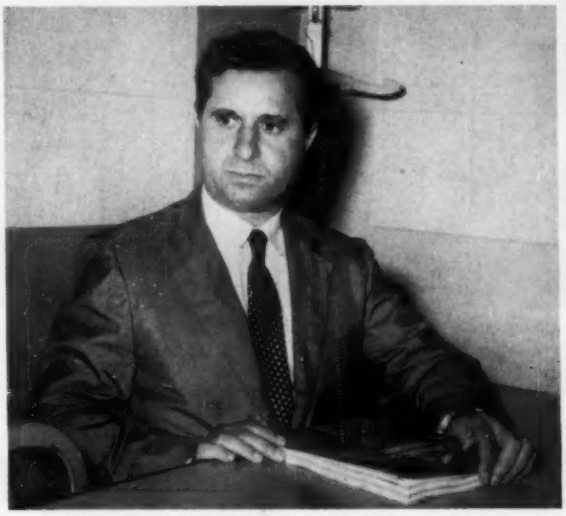
Q. Does the government encourage United States investment in Greek mines?
A. Yes, of course. My government is very eager to get capital because the venture capital in Greece is so small, and limited to only a few companies. As an example, the asbestos deposit was called to the attention of Greek companies who couldn't advance several tens of thousands of dollars for exploration. In contrast, Kennecott gave $3,000 for an extensive government geological survey, may spend as much as $300,000 in exploration, and several millions of dollars if the mill is built.

The biggest encouragement the government offers is a favorable tax. In the Kennecott agreement there will be no taxes or royalty of any kind until Kennecott has recovered

Kyriacos E. Zachos is the director of Greek Institute for Geology and Subsurface Research, equivalent to the Greek Geological Survey. He also has the imposing title and important position of Director General of the Greek Ministry of Coordination, in which capacity he is the technical advisor to the government for all phases of mining, oil and water exploration, and production. He is also president of the Greek Mining Engineering Association.

He was educated in Greece and Germany; holds a degree in Physics from the University of Athens; and mining engineering and Doctor of Mining Engineering degrees from the Berlin Technical University.

His first position was as a mining geologist and geophysicist for the German Reichsamt fuer Bodenforschung in Berlin. From 1943 to 1947 he was a prospecting engineer for several Greek companies. In 1947 and 1948 he worked for Atkinson-Drake, a United States contracting company, as foundation and tunneling engineer. He has held his present Greek government position since 1948.



the total cost of its investment. Only after that will the government and Kennecott share equally in profits from the operation.

Q. What are the chief minerals produced in Greece?
A. Bauxite, chromite, manganese, nickel, magnesite, lead, zinc, barite, iron, emery, and recently perlite. They are mined by Greek companies.

Q. Are the minerals concentrated, smelted, or refined in Greece?
A. Only lead and nickel are smelted or refined in Greece. The manganese and chromite are given an ore dressing treatment.

Q. What are the markets for these minerals?
A. West Germany, Sweden, England, and the United States. I have just received word from my office that a ship load of chromite has just been sold to the Vanadium Corporation of America.

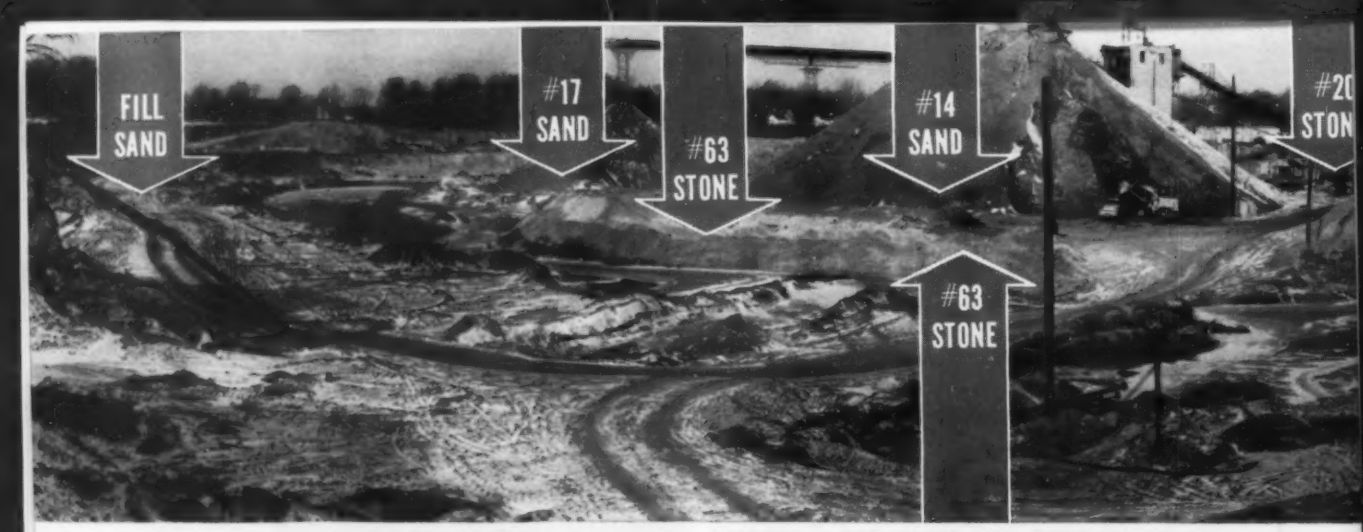
Q. What are the major functions of your department?
A. Ore and water exploration, geological mapping, geophysical surveying, and core drilling. Water is very important and my staff is constantly seeking new sources of underground water.

Q. How large a staff do you have?
A. There are 25 scientists and engineers and 10 technicians. My department does all the geologic mapping for the country, searches for buried deposits, and has a large laboratory staff doing ore dressing and testing work. Another government bureau is in charge of safety and mining statistics.

Q. What success has your department had?
A. Results have been very satisfactory. Especially so when one remembers that Greece is a very old country and that one of the oldest mining operations in the world is in Greece. It is the lead-silver mine of Compagnie Francaise des Mines de Laurium where more than 300,000 meters of underground workings were driven centuries ago. The Department located the asbestos deposit I mentioned while mapping a large serpentine area for chromite. Geophysical surveys have located buried barite deposits. Unknown deposits of iron, chromite and manganese have been found, too.

Q. How will your visit to the United States help your department do a better job?
A. I am very interested in research laboratories and, as you know, have visited several and will take back many ideas for improvement. I came to California because there are many areas of serpentine similar to those in Greece. I have seen mines in California where mercury occurs in serpentine. Now I will know better how to look for similar ores in Greece. Also I will visit the rare earth deposits near Nipton, California so that I can learn what they look like. No one has ever known what rare earths are in my department. There are also many black sand beach deposits in Greece. I am sure they contain zircon, and titanium minerals. I have already seen the Florida heavy mineral plants and will investigate the beaches upon my return. Also I am convinced that there are scheelite deposits in my country. They are very hard to recognize and nobody has known what to look for. But there are many contact metamorphic deposits with what you call tactite and they must be investigated for scheelite.

Q. Can you tell me what your address will be in the United States?
A. My permanent address is in care of the Eisenhower Fellowships, 256 S. 16th Street, Philadelphia, Pennsylvania.



Same hours, same manpower, yet by changing loaders

INDIANA QUARRY QUADRUPLES PRODUCTION

With the same *number* of loaders, and virtually the same number of man-hours, May Sand & Gravel Company, Fort Wayne, has *quadrupled* production (and sales) over the past few years.

Key to their 750,000 ton yearly success story has been the three Michigan Tractor Shovels they brought in to replace a number of less mobile loading units.

Load 550 trucks with 4,500 tons

Accurate records, covering a two year period, show the three Michigans load from 300 to 550 trucks *every nine hour shift.* During peak days their output totals 4,500 tons —a per-unit per-hour average of 175 tons!

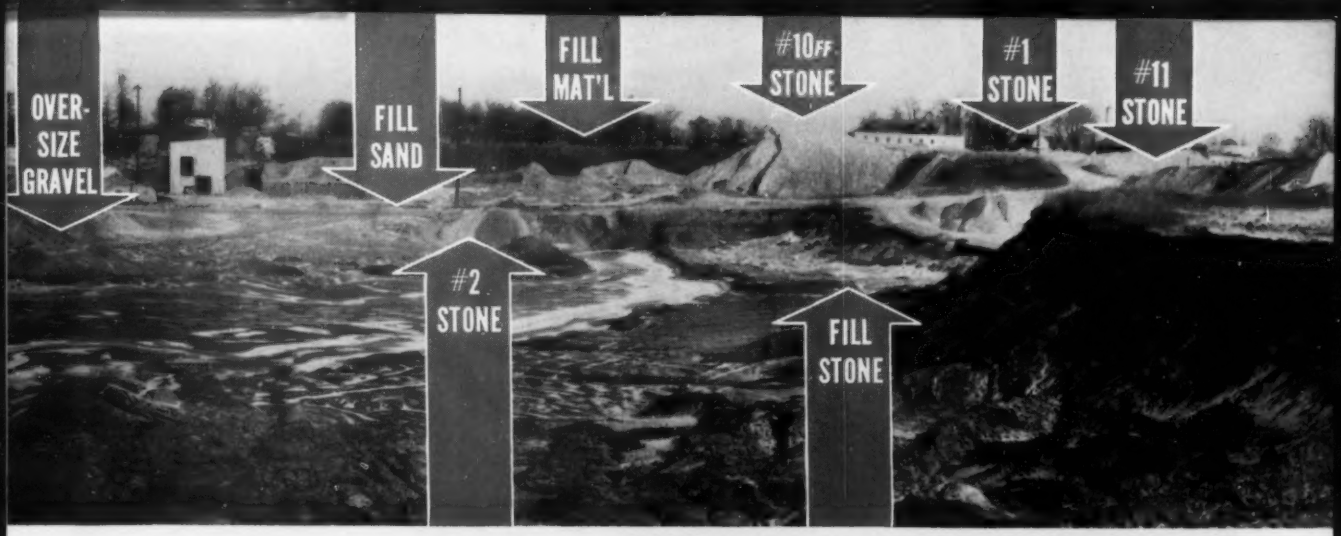
Truckers clear $25 more per day, end gripes

This excellent record has been compiled with only minor changes in methods. Trucks, for example, still are loaded in the order they come into the pit. Formerly, this practice caused frequent delays, often 20 to 40 minutes, while old-style loaders crawled between stockpiles, or labored to load the tougher materials. Now, *even on busiest days,* the Michigans work so fast no trucker waits longer than 2 to 10 minutes from time he drives into the yard until time he's loaded and pulls off the scales. "Trucker gripes have almost disappeared," says Company President Bill May. "The saving of 10 to 30 minutes in pit service often enables each truck to deliver another load or two a day when on long 15 mile hauls . . . an extra two to four loads a day when on shorter one to five mile hauls. That's an extra profit per truck of $5 to $25—or more—every day!"

Fast as trucks between stockpiles

Two major factors combine to produce this time saving. First, the mobile Michigans move from stockpile to stockpile just about as fast as the trucks. Second, the Michigans rapidly load all 10 sizes of stone, two types of gravel, and two grades of sand sold by this plant. Stopwatch measurements, taken from time to time during the past two years, show the 2¾ yard Michigans require only 1½ to 1¾ minutes to heap a 5 yd truck . . . 2¼ to 2½ minutes to load a 9 yarder.

Typical Michigan 2¾ yd load of #14 sand, heaviest of 14 materials handled, weighed out on company scales at 9,000 lbs.



Truck-like speed between stockpiles saves about 1¼ hours per day over crawler-loaders formerly used. Supt. Rooney estimates this time saving, plus lowered repairs, plus faster loading nets his company $70 extra profits per Michigan per shift.

Easy accessibility speeds maintenance

Another important factor in increased plant production has been *dependability*. May Sand and Gravel records show that *not once* in 5½ machine years has a Michigan missed more than a few hours of work. "Sure, we expect our rough service to take its toll," says Jim Rooney, Supt. "But we have a regular program of daily and 100 hour maintenance and inspection that catches what few troubles a Michigan has while they're small. Even when we spot something, even in the rare cases a Michigan breaks down, we always have the machine back to work the next morning! Easy accessibility, skilled workmen, and excellent distributor cooperation make repairs a simple job."

Also do such "extra jobs" as bank loading, pit cleanup

Speed and efficiency help out on extra jobs, too. Three hours every night, and sometimes during the day, one or two of the Michigans clean the quarry floor (this eliminates need for special tractor). Sometimes they load sand fill from bank direct into trucks. At times they level the gravel stockpiles. From 5 to 10 pm some evenings, two of them load non-blasted bank-run sand and gravel. Three trucks are kept busy hauling 2,000 ft to plant for processing. Only light source is own headlights. Average production: 230 tons per hour. And the Michigans have ended worries about rock shovel breakdowns. Supt Rooney reports production loading shot rock with a Michigan of 190 to 200 tons every hour.

Is it any wonder, with all-around performance like this, that May Sand & Gravel Company think Michigan "tops". We think, if you try one, you'll agree. Make your own test. Call or write to arrange a demonstration. You name the job!

Michigan is a registered trade-mark of

CLARK® EQUIPMENT

CLARK EQUIPMENT COMPANY
Construction Machinery Division
2493 Pipestone Road
Benton Harbor 37, Michigan
In Canada: Canadian Clark, Ltd.
St. Thomas, Ontario

One of Michigan's "spare-time" jobs: hurrying to edge of 30 acre quarry to push off truck-dumped #1 stone.

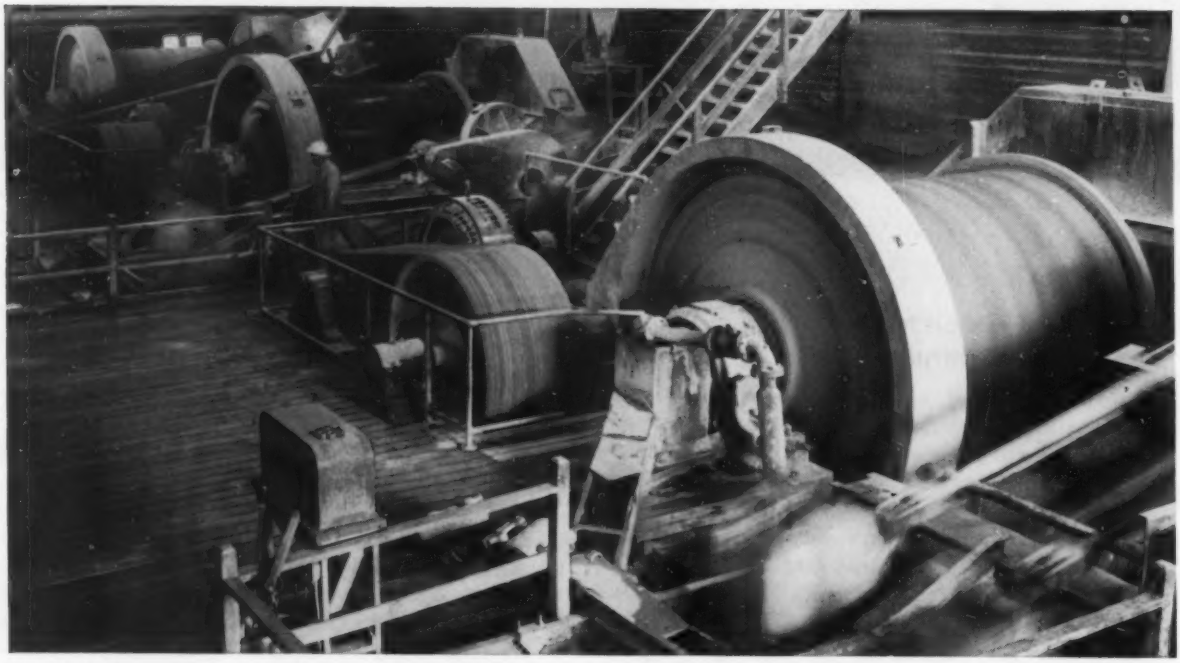
Excellent service and cooperation from local distributor Deeds Equipment Company is one important reason for May's repeat purchases.

ENGINEER'S FIELD REPORT

PRODUCT CHEVRON GEAR COMPOUND

FIRM BAGDAD COPPER CORP.
Bagdad, Arizona

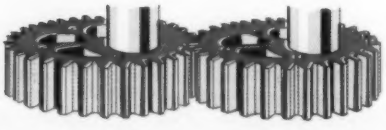
Not one gear failure using Chevron Gear Compound



During 5 years that Bagdad Copper Corp. has used Chevron Gear Compound (formerly Calol) in its ore concentrator mill, not a single gear has broken down, required repair or replacement as a result of lubricant failure. Despite continuous operation and extreme pressure, gear teeth show no scuffing or galling. Mill moves some 4,000 tons of ore through its four ball mills and classifiers every 24 hours.

Enclosed gears of firm's four Western Machinery classifiers are lubricated with Chevron Gear Compound. Copper ore is pulverized in ball mills by tumbling with 32 tons of 3" steel balls. Classifiers then screen out oversize pieces for return to ball mills. Reduction gear box which Master Mechanic Al Smith is inspecting (above) powers connecting arms which agitate mixture of pulverized ore and water in classifier.

Why Chevron Gear Compound protects enclosed gears



- Tough film protects gear teeth against scuffing and scoring under severe shock, load conditions.
- Highly adhesive...clings to gear teeth and bearings, even under wet operating conditions.
- Oiliness additive reduces friction

For More Information on this product contact your nearest representative, or write direct to any company listed.

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Mechanization returns greater dividends with

Edison R-4 Cap Lamps on the job

Edison R-4 Electric Cap Lamps can help modern mining machines realize their *full* potential.

Reason why? Because more and better light is always on the job with the brilliant, unfailing beam of the Edison R-4. This dependable source of illumination permits the miner to perform his duties with utmost efficiency and safety. You don't have long to wait for results with the Edison R-4, either. They register quickly in terms of accident prevention and increased tonnage per man-shift.

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TOUGH. *ESCO* 12M Scraper and Dozer Cutting Edges last longer under every digging condition. Because of its high-strength, wear-resistance and shock-absorbing toughness, *ESCO* 12M increases cutting edge life, reduces down-time and keeps your equipment operating far more profitably on every job.

TEMPERED. *ESCO* Cast 12M Cutting Edges are Oven-Tempered – that's why the same tough "edge-metal" extends all the way through; there is not just a thin shell of hard surface metal that soon wears away. *ESCO* Cast 12M Scraper Cutting Edges will actually outwear ordinary rolled steel blades 5 to 1, and stop blade breakage.

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Rugged body and frame withstand the impacts of loading, hauling and dumping heavy excavation in construction, mine and quarry service.

SPEED AND STABILITY

The 5-speed transmission and Euclid planetary axle provide top speeds with full payload up to 27 m.p.h. Free-floating Euclid spring suspension gives maximum stability empty or loaded under all road conditions . . . permits faster safe travel speeds.

18-ton payload with 16.00 x 25 tires

OUTSTANDING FEATURES OF THIS 18-TON "EUC" REAR-DUMP

- **36,000 lb. payload**
- **10½ yd. body**
- **218 h.p.**
- **16.00 x 25 tires**
- **hydraulic booster steering**
- **air assist clutch**

Here's the New R-18 "Euc"

that sets a new high in Rear-Dump Performance!

For over 20 years Rear-Dump "Eucs" have paced the field in mine, quarry and construction work. They have delivered "plus" performance year in and year out on hundreds of the toughest jobs.

This Model R-18 incorporates the engineering advances, easy operation and maintenance features resulting from unequalled field experience with other Euclids of the same capacity. Dependable work-ability means more payloads per day at lowest cost per ton or yard moved.

Have your Euclid dealer give you the full details on this new 18-ton Rear-Dump and the complete line of Euclid earth moving equipment. He'll be glad to show you why so many users have proved for themselves that ***Euclids are your best investment.***

EUCLID DIVISION, General Motors, Cleveland 17, Ohio

Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

Before you buy any giant-sized

Measure TD-24 giant-sized

With full-time "live" power on both tracks, the TD-24 almost builds the road itself—hugging the mountain slope, giving added *operating ease, safety, and capacity!* That's another bonus from exclusive time-proven Planet-Power steering.

When you're 'dozing through rock and other materials, instant fingertip Hi-Lo shifting is a big cycle-speeder. And it cuts operator effort way down!

Try holding a 19-ton load on the blade with any other crawler this big—making a turn as this TD-24 is doing with both tracks pulling, while stockpiling coal with a special wing-type blade. The TD-24's operator can make "round-house," feathered, or pivot turns—with fingertip ease!

tractor advantages!

When you buy a big crawler look beyond sheer size and weight. You may be paying for enough extra "iron" to cause a startling jump in fuel and upkeep costs. So compare. Weigh bigness against provable working and earning capacity! Measure these giant-sized TD-24 advantages that have proven out over 8 years of on-the-job success!

Eliminates "dead-track drag!"

Does the giant you're considering steer with full-time "live" power and "live" traction on both tracks? TD-24 users by the thousands have proved that any crawler *this big* is obsolete without exclusive, time-proved Planet-Power steering advantages!

Planet-Power steering eliminates power-wasting, load-limiting "dead-track drag." Upgrade, downgrade, or on the level, you can smoothly turn a heavily-loaded TD-24—under positive control!

Does the big one you're looking at give cycle-speeding on-the-go shifting? The TD-24 does! And the exclusive two-speed planetary system teamed with a 4 speed synchromesh transmission —gives instant, stall-preventing and time-gaining Hi-Lo shifting, *without declutching.*

Does that big one you need have the genuine in-seat, seconds-fast, all-weather International gasoline conversion starting? Or the operating ease, power-transfer efficiency, and service-simplicity of the International Cerametallic-faced engine clutch? Or 8 practical speeds *forward and reverse?* Only the TD-24 has all these, plus dozens of other giant-sized advantages!

Prove to yourself the TD-24 beats all other giant-sized power—for *performance value*—for *big-scale ability to make you big money.* Ask your International Construction Equipment Distributor for a demonstration of a Gear-Drive or Torque-Converter TD-24!

INTERNATIONAL® CONSTRUCTION EQUIPMENT

International Harvester Co., 180 N. Michigan Avenue, Chicago 1, Illinois

A COMPLETE POWER PACKAGE INCLUDING: Crawler, Wheel, and Side-Boom Tractors ... Self-Propelled Scrapers and Bottom-Dumps ... Crawler and Rubber-Tired Loaders ... Off-Highway Trucks ... Diesel and Carbureted Engines ... Motor Trucks

Heap-loading the sideboarded International "75" Payscraper in less than a minute proves the economy and efficiency of the TD-24 as a "pusher."

How a sand and gravel plant
SAVES UP TO $162 PER WEEK

Amsco® Semi-automatic S/A-53 Tube Rod... used in place of a competitive semi-automatic rod, is saving a large sand and gravel operator up to $162 per week on roll crusher hardfacing. And this is done with no loss of service life . . . no increase in welding time or rod consumption.

These roll crushers handle 3000 tons of gravel per week, work 10 days between hardfacings. Replacement rolls are hardfaced daily, using about 50 lbs. of rod.

You can make comparable savings by using Amsco S/A-53 Tube Rod in severe impact-abrasion service. S/A-53 is designed especially for use with Amsco MF Semi-automatic Welders, but other machines may be easily adapted to accommodate its $^3/_{32}$" diameter.

S/A-53 is a prehardened, pre-lubricated, high-chromium alloy rod . . . easy to weld on carbon or manganese steel. Deposits from 5 to 15 lbs./hr. according to current settings. Deposit hardness averages 425 to 475 Brinell.

Any Amsco Distributor will give you a chance to try S/A-53 in an Amsco MF Semi-automatic Welder. Why not take him up on it and test the savings yourself?

Write for Bulletin 656, describing S/A-53 and the complete Amsco "wear-fighter" welding line in detail. Address: Amsco Welding Products Department, Chicago Heights, Ill.

Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.

AMERICAN Brake Shoe COMPANY

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American Manganese Steel Division • Chicago Heights, Ill.

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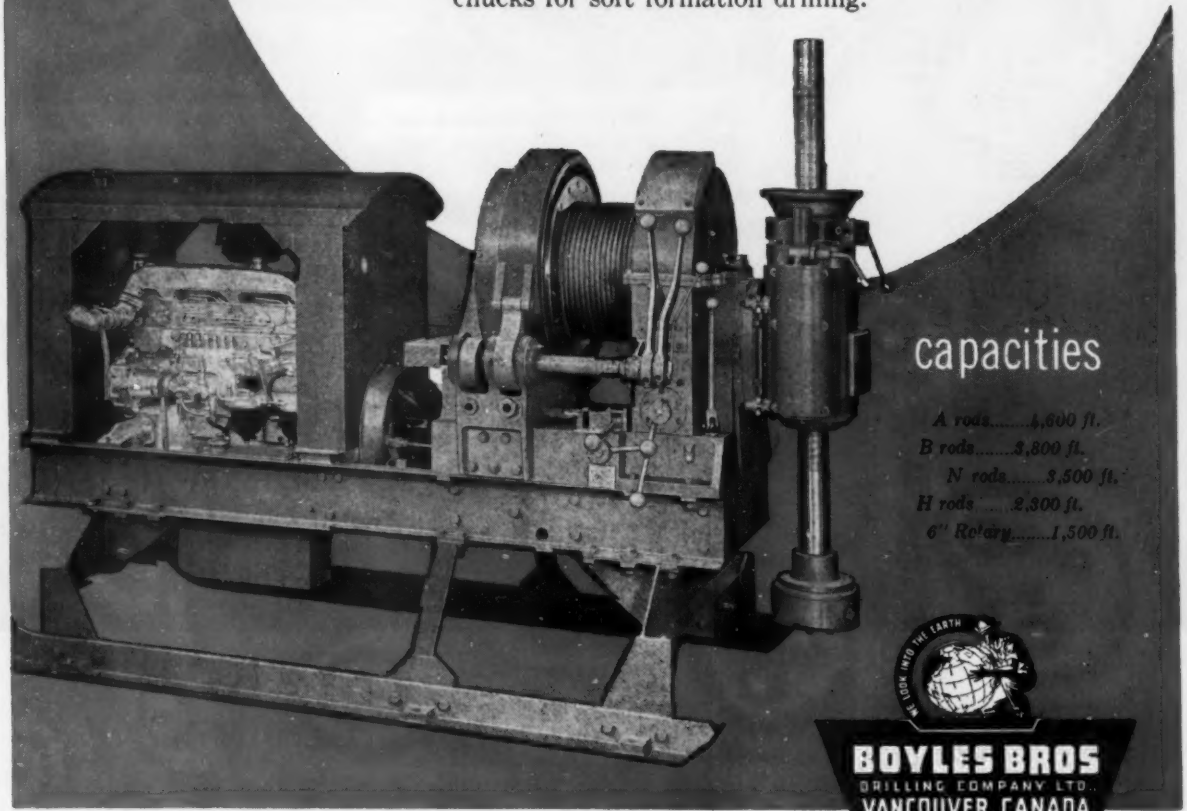
now...the BBS-3 for deeper diamond drilling

Here is the newly developed BBS-3 surface Diamond Drill. Like the well-known BBS-2SR and BBS-4 models the new BBS-3 is designed for speed, strength and ease of operation even under the most severe conditions.

Powered by a Perkins 95 h.p. R6 diesel or an optional 95 h.p. Hercules DJXH diesel, the BBS-3 has a neutral plus four forward and four reverse gears for either the hoist or the swivelhead. Other features include a strong high-speed hoist with speeds to 850′ per minute, choice of gear or hydraulic swivelheads, fast self-centering hydraulic chucks for soft formation drilling.



capacities

A rods.....4,600 ft.
B rods.....3,800 ft.
N rods.....3,500 ft.
H rods.....2,300 ft.
6" Rotary.....1,500 ft.

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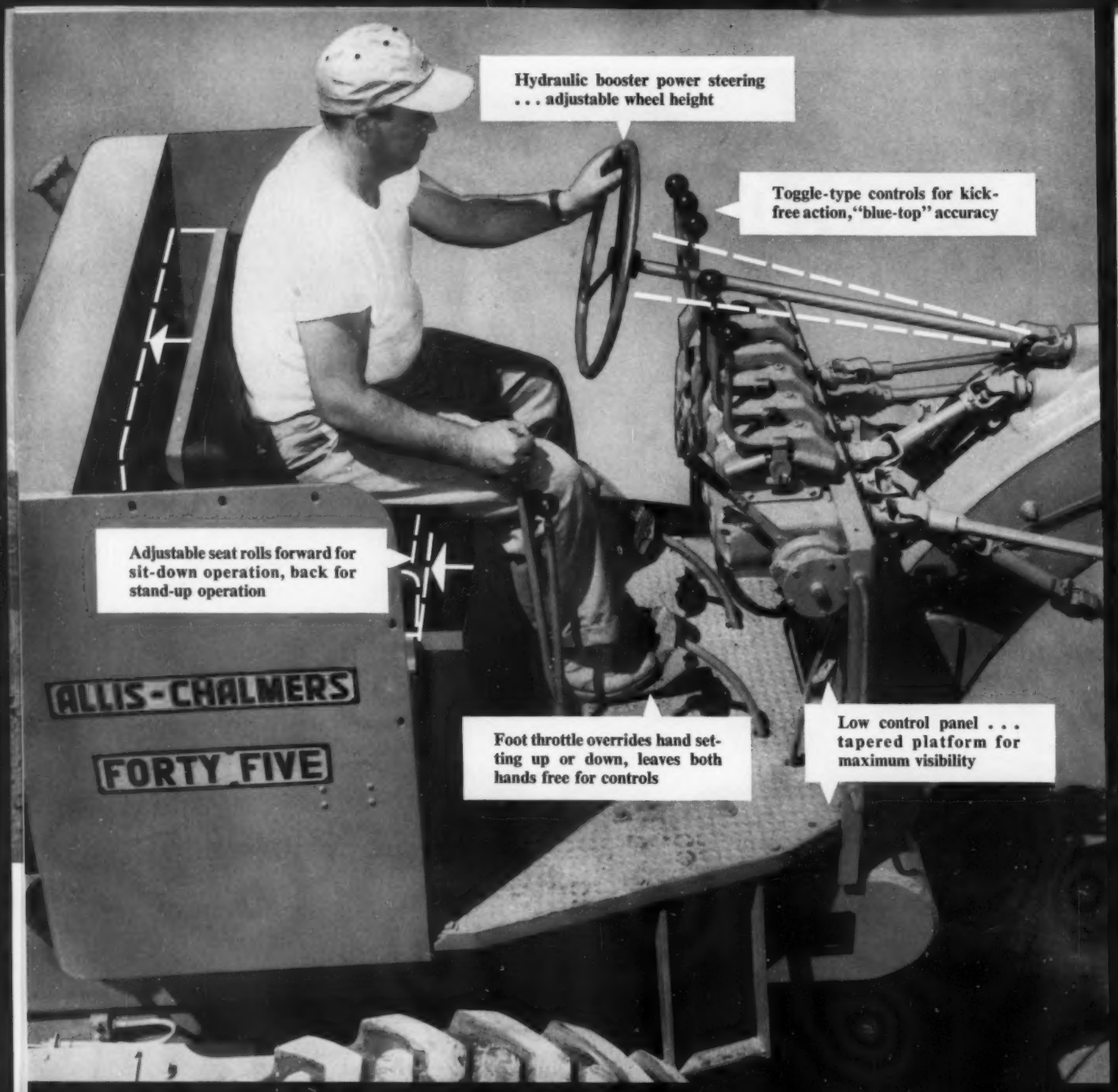
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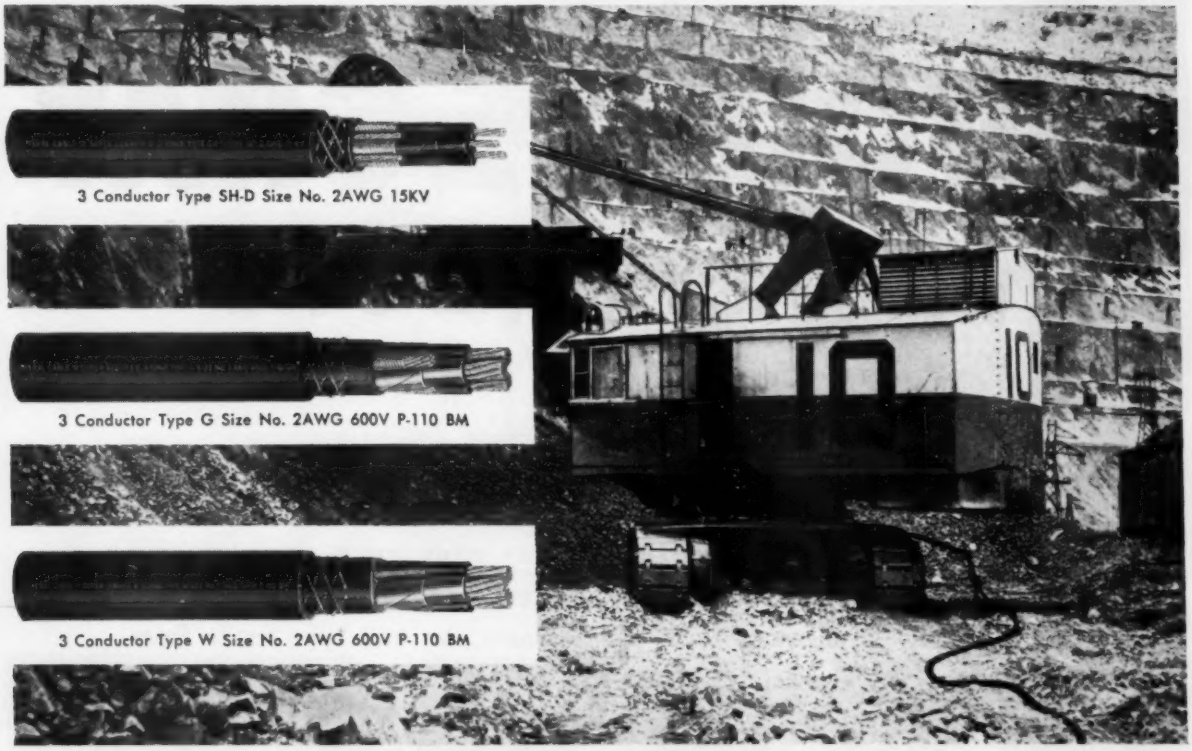

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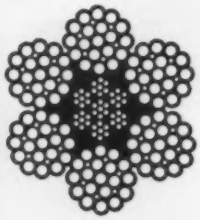
WIRE ROPE



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Double Gray is *not* a new rope . . . *not* a rope that's offered to you on an "experimental" basis. Instead, it's been thoroughly tested in both the field and the laboratory. This means that you can now get extra high strength ropes with greater abrasion and crushing resistance . . . *plus* the knowledge that you're using a *safe* wire rope that's made by a company long known for its top-quality products.

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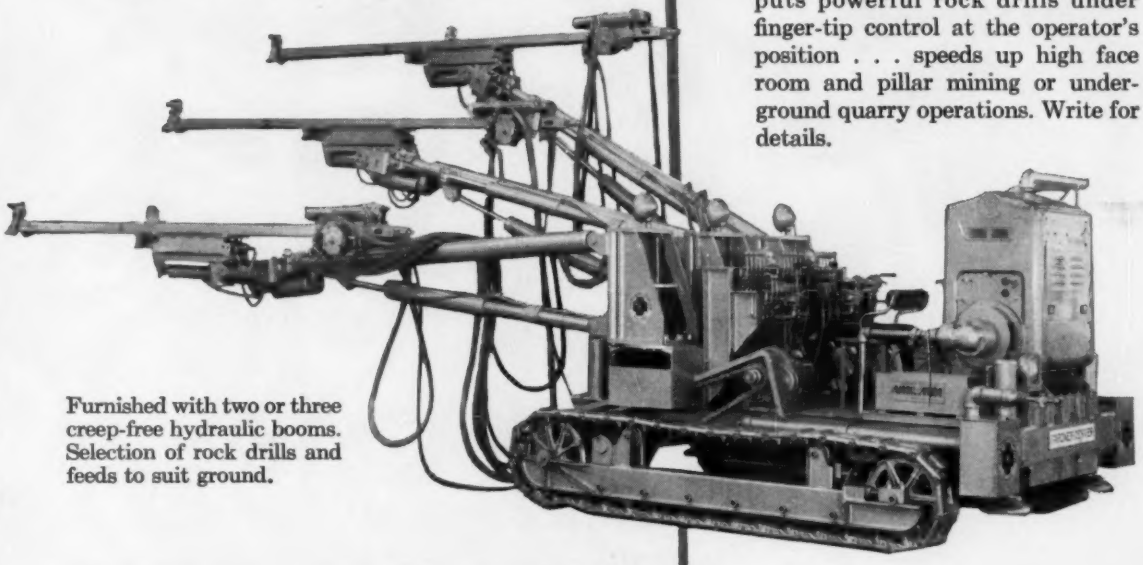
LOOK FOR THE YELLOW TRIANGLE

5078

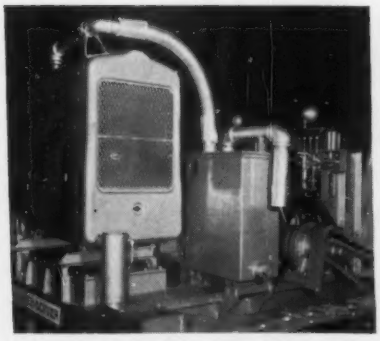
A new way to make man-hours more productive in your mine

THE NEW GARDNER-DENVER
JMT "MOBILJUMBO"®

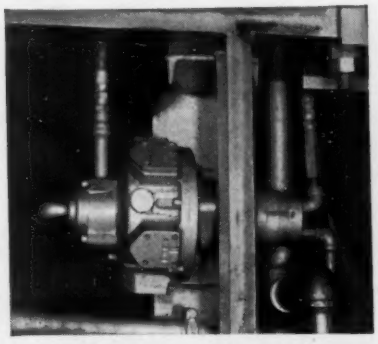
"Push-button" rock drilling with the new Gardner-Denver JMT "MOBILJUMBO" offers new opportunities to increase productivity with less effort. The new JMT self-propelled, crawler-mounted jumbo puts powerful rock drills under finger-tip control at the operator's position . . . speeds up high face room and pillar mining or underground quarry operations. Write for details.



Furnished with two or three creep-free hydraulic booms. Selection of rock drills and feeds to suit ground.



Available with diesel-hydraulic drive to the crawlers, or with crawlers powered by 5-cylinder radial air motors.



Air motor drives hydraulic pump for remote hydraulic control of boom and drill positioning by one man.

Electric generator, air motor driven, supplies three lights that flood working face, light drilling operations.

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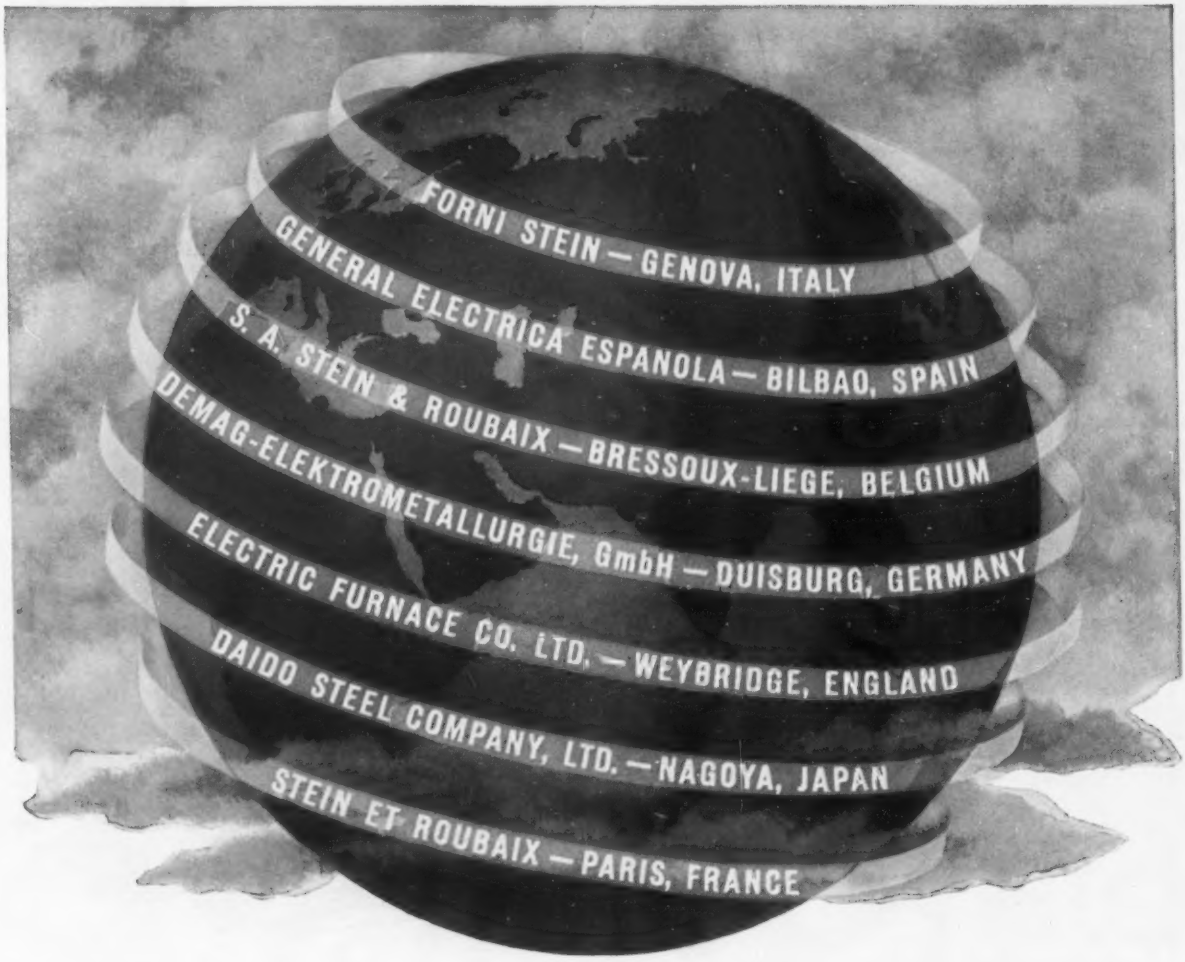
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Metallurgical and chemical industries the world over use Lectromelt . . . the efficient, versatile electric furnaces designed by Lectromelt of Pittsburgh, U.S.A.

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**Reg. T. M. U. S. Pat. Off.*

Everytime a "95" Payhauler® leaves this shovel,

Camp Co. gets an extra 5 yds!

Day-to-day operational studies at Camp Concrete Rock Co., Brooksville, Fla., prove it! *Two International "95" Payhauler trucks, working with other haul units in the same capacity and power class, each carry an extra five yards every time they leave the 2½-yard shovel!* Loading time averages 2½ minutes for eight dippers or 20 yards. Haul length is approximately ¾ miles and includes a 10% adverse grade. The loaded Payhauler trucks travel this distance in 3 minutes, easily reaching load-carrying speeds of 34 mph. The empty return trip takes only 2 minutes, with the Payhauler trucks reaching top speeds of 38 mph.

Counting waiting, spotting time over the grizzly, and dumping time, the Payhauler trucks average a complete cycle approximately every ten minutes. During Camp Concrete Rock Co.'s nine hour day, *this means an impressive total bonus yardage of approximately 225 yards per day from each Payhauler*... an International-inspired saving of thousands of dollars yearly over Camp Co.'s other units.

You've probably read of similar outstanding International Payhauler successes in the rock, stone, and quarrying industries. Now try the amazing "95" and "65" Payhauler first hand. Test the safe and easy full-load maneuverability...the ample power of the 335 hp turbo-charged diesel engine in the "95," and 250 hp turbo-charged diesel engine in the "65." Check fuel consumption, too. See how you can bank *10%* savings, as well. Your International Construction Equipment Distributor will be glad to give you an eye-opening demonstration.

INTERNATIONAL® CONSTRUCTION EQUIPMENT

International Harvester Co., 180 N. Michigan Avenue, Chicago 1, Illinois

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors... Self-Propelled Scrapers ... Crawler and Rubber-Tired Loaders... Off-Highway Haulers... Diesel and Carbureted Engines... Motor Trucks... Farm Tractors and Equipment.

PREVENTION OF ACCIDENTS IN THE USE OF EXPLOSIVES
Approved by the Institute of Makers of Explosives, September 30, 1955
READ DO'S & DON'TS CAREFULLY
THE prevention of accidents in the use of explosives is a result of careful planning and observance of the best known practices. The explosives user must remember that he is dealing with a powerful force and that various devices and methods have been developed to assist him in directing this force. He should realize that this force, if misdirected, may either kill or injure both him and his fellow workers.
WARNING: All explosives are dangerous and must be handled and used with care either by or under the direction of competent experienced persons. It is the responsibility of all persons who handle explosives to know and to follow all approved safety procedures.
It is obviously impossible to include warnings or approved methods for every conceivable situation. A list of suggestions to aid in avoiding the more common causes of accidents is set forth herein. Additional information is available in the Institute of Makers of Explosives Publications listed: "Standard Storage Magazines" (Pamphlet #1); "American Table of Distances" (Pamphlet #2); "Safety First Rules for Handling, Storing, Delivering and Shipping Explosives" (Pamphlet #5); "Safety in the Handling and Use of Explosives" (Pamphlet #17); "Radio Frequency Energy—A Potential Hazard in the Use and Transportation of Electric Blasting Caps" (Pamphlet #20); "Explosives in Agriculture", and "How to Destroy Explosives". When in doubt, consult the manufacturer.
DEFINITIONS
1. The term "explosives" as used herein includes any or all of the following: Dynamite, black blasting powder, pellet powder, blasting caps, electric blasting caps, and detonating fuse.
2. The term "electric blasting cap" as used herein includes both instantaneous electric blasting caps and all types of delay electric blasting caps.
3. The term "Primer" as used herein means a cartridge of explosives in combination with a blasting cap or

Send for your FREE COPY of do's and don'ts with explosives!

Everyone who has anything to do with explosives should have a copy of this new, revised, up-to-date list of *instructions and warnings*, approved by the Institute of Explosives Makers.

It covers important functions in the handling and use of explosives—*lists 72 Do's and Don'ts* for prevention of accidents in handling, transporting, storing, loading, tamping, shooting and disposal.

Contains vital precautions when shooting either electrically or with cap and fuse . . . eleven suggestions for minimizing poison gas hazards . . . prevention of misfires . . . approved methods for priming. Send for your *free copy today!*

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Explosives Division
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Wilmington 99, Delaware

Please send me a copy of the new "DO'S and DON'TS with Explosives."

Name_____

Company_____

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United States

Personalities in the News——

ROBERT R. DURK has accepted the position as manager of sales — mining equipment for Sanford-Day Iron Works, Inc., and will handle equipment made for the hard rock mining industry. Mr. Durk was formerly with Standard Uranium Corporation at Moab, Utah as general superintendent, and before that held capacities ranging from chief mine engineer to mine superintendent for Combined Metals Reduction Company.

Andrew Fletcher, president of St. Joseph Lead Company, has been re-elected president and chairman of the board of the Lead Industries Association. **Kenneth C. Brownell**, chairman of the board, American Smelting & Refining Company, **Joseph A. Martino**, president of National Lead Company, and **Miles M. Zoller**, vice president of The Eagle- Picher Company, were reelected vice presidents. **Robert L. Ziegfeld** continues as secretary-treasurer.

S. D. Strauss was recently elected president of the American Zinc Institute. Mr. Strauss is vice president and manager of sales, American Smelting and Refining Company, and replaces **Fred S. Mulock** as president of the Institute. Vice presidents elected were **J. D. Bradley**, The Bunker Hill Company; **Clarence Glass**, Anaconda Sales Company; **H. L. Young**, American Zinc Sales Company. **E. V. Daveler**, American Zinc, Lead and Smelting Company, continues as treasurer, and **J. L. Kimberly** was reelected executive vice president and secretary.

P. B. Entrekin has been named a director of Bethlehem Steel Corporation and assistant vice president, mining division. He has been general manager of the division since 1949. **E. P. Leach** is the new general manager, and was previously assistant to the vice president, mining division.

W. Basil Leach, previous vice president and director of sales, has been named president of Mexico Refractories Company. The company's founder, **John B. Arthur**, has been elevated from the presidency to chairman of the board and chief executive officer. **C. A. Smith**, vice president and chief engineer, is now executive vice president and retains the responsibility of chief engineer.

Robert F. Marek has been named manager of technical and management procurement, a new position at International Minerals and Chemical Corporation, Chicago. He joined the company in 1951 as manager of industrial engineering and later became assistant to the engineering director. In his new position he will be in charge of executive personnel procurement and long-range organizational forecasting.

Alan A. Fisher, president of ACE Drill Bushing Company, Inc., Los Angeles, and general manager of West Coast Aero Tool Company of Arlington, California, has been appointed chairman of the board of Atlas Uranium Corporation. The appointment resulted from a merger of Bleak Uranium Corporation with Atlas. Mr. Fisher was a director of Bleak at the time of merger.

Frank J. Smith, Duluth mining executive who helped develop the taconite operations of Reserve Mining Company at Babbitt and Silver Bay, Minnesota, has retired as vice president of Oglebay, Norton and Company. Mr. Smith joined the company in 1908 and has been vice president in charge of iron ore operations since 1950.

A. P. Kibbe has withdrawn from the Salt Lake investment firm of A. P. Kibbe & Company to devote his full time to Lisbon Uranium Corporation, of which he is the founder and president.

Dr. Edwin G. Koch has assumed responsibilities as president of the Mining College of the Montana School of Mines. He was formerly head of the chemistry department and in his new position succeeds **Dr. Robert Van Pelt** who is now president of Michigan School of Mines and Technology.

STEPHEN E. ERICKSON is the new director of beneficiation at the Cooley laboratory of the M. A. Hanna Company, replacing A. E. MATSON, retired. Mr. Erickson received his degree in metallurgical engineering from the University of Minnesota in 1933, spent a year at the mines experiment station, and was employed in the Cooley laboratory during 1934. He has held positions in various parts of the United States and in 1946 joined Hanna as beneficiation engineer.

Ray L. Schultze is the new general superintendent of Rio De Oro Uranium Mines, Inc. and will make his headquarters at the Dysart mine in the Ambrosia Lake area of New Mexico. Mr. Schultze has been a mine superintendent for the National Lead Company at Fredericktown, Missouri, and two years ago joined the Hidden Splendor Mine Corporation as mine superintendent for the Delta mine near Green River, Utah. More recently he served at Hidden Splendor's Far West mine as assistant general superintendent. Hidden Splendor, a wholly owned subsidiary of the Atlas Corporation, recently acquired a controlling interest in Rio De Oro.

Jay B. Ford, assistant general manager of the U. S. Potash Company Division, Carlsbad, New Mexico, has been promoted to assistant general manager of the Pacific Coast Borax Company Division of the United States Borax & Chemical Corporation.

Roy H. Glover, chairman of the board of directors of The Anaconda Company, delivered the address at the 57th commencement exercises of the Montana School of Mines, June 7, and received an honorary doctor of laws degree.

R. W. Whitney, Jr., former-y at the M. A. Hanna Nickel operation in Oregon, has returned to the Mesabi Iron Range in the capacity of assistant superintendent of Hanna's Mississippi group at Nashwauk, Minnesota.

Judson H. Whitman has been appointed mining engineer in the rare earths and thorium division of Michigan Chemical Corporation. From 1952 to 1956 Mr. Whitman was with Cia. Mineray Refinadora Mexicana, S.A., a subsidiary of National Lead Company in Mexico, as geologist and in the mining department. Following that he accepted geological assignments in Costa Rica and Panama. His new headquarters will be in Golden, Colorado.

John Q. St. Clair, consulting mining geologist of Grand Junction, Colorado, has announced the opening of new offices at 406 San Mateo, N.E., Albuquerque, New Mexico.

The new Alaska Land Board, created by Chapter 184, SLA 1957, has announced that a director is needed for the Territorial Department of Lands. According to the Board, applicants should have administrative experience, preferably in land management. The Legislature established a salary of $12,000 per year for the office. The term is four years, with the appointment to be made by the Land Board. Applications should be submitted to Phil R. Holdsworth, Board Chairman, P. O. Box 1391, Juneau, Alaska.

W. J. Williams has been named general manager of taconite operations for Pickands Mather & Co. Mr. Williams became associated with the company in 1954, after seven years with the United States Atomic Energy Commission. **Donald M. Chisholm** is the new assistant general manager of taconite operations, and **Leonard E. Johnston** is works manager.

George Wingfield, president of Goldfield Consolidated Mines Company and part owner of Goldfield Florence Mining Company, will receive an honorary degree of doctor of mining economics from the University of Nevada. Mr.

Continued on page 114

BLAKE FOX (left) is now associated with ROBERT FORD, consulting mining geologist, in Riverton, Wyoming. Mr. Fox has been employed for the last three years in Wyoming with Ohio Oil Company, and is a specialist in petroleum geology. Mr. Ford has been a consulting geologist in Riverton for two years, and before that was assistant chief geologist for Pickands Mather & Co. The new partnership of Ford and Fox maintains offices in Riverton at 206 South Broadway, P. O. Box 428. Also associated with the firm are ROBERT BESEDA, geological engineer, and JACK O'LEARY, mining engineer.

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. . . designed to take full advantage of longer-lasting, faster-drilling CARSET JACKBITS

The exceptionally light-weight and well-balanced design of the Ingersoll-Rand R-38A Stopehamer pays off in increased production. It not only weighs up to *26% less* than older-type stopers, but also uses *25% less compressed air.*

Built to stay underground this powerful, light-weight drill has automatic rotation, self-cleaning chuck, graduated throttle for easy collaring and protected exhaust ports. Ask your I-R representative for complete information on the cost-cutting R-38 Stopehamer.

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Newsmakers in International Mining

GEORGE C. HEIKES has joined Continental Uranium, Inc. in the newly created position of manager of mineral resources. Mr. Heikes has held the position of chief mining engineer for the National Lead Company; during World War II, he served on the War Production Board as director of the Zinc Division, and later as director of the Aluminum-Magnesium Division. After the war he was appointed chief of the mining branch of the Economic Cooperation Administration in Greece, and since then has acted as a mining consultant in this country.

Robert H. Carpenter, geology professor at the Colorado School of Mines, has been awarded a post-doctoral Fulbright Fellowship by the United States Department of State and a grant from Il Circolo Italiano to do research work in Italy. Il Circolo Italiano is a Denver organization which also sponsors a graduate student from Italy at Colorado School of Mines.

Norman Wright, former assistant smelter superintendent with Roan Antelope Copper Mines, Luanshya, Northern Rhodesia, has been transferred to the company's subsidiary, Ndola Copper Refineries, as metallurgical superintendent in charge of both the copper section and the cobalt plant, which will handle Chibuluma cobalt concentrate.

Professor E. L. J. Potts, Milburn Chair of Mining at the University of Durham, England and world authority on strata control and rock mechanics, lectured during April and May at the University of Minnesota School of Mines and Metallurgy. **Professor Otto Rellensmann**, dean of the Mining Academy at Clausthal, Germany, lectured on "Mine Subsidence" and the "Gyroscope in Mining." Professor Rellensmann introduced the first portable seismograph on the Gulf Coast in 1923, and has developed a "Meridian Indicator" which employs a gyroscope to transfer the meridian underground with great accuracy.

K. C. Maithal, mining engineer for the government of India, has been promoted to controller of mines for the Ministry of Natural Resources and Scientific Research, with headquarters at Calcutta.

P. C. Emrath, former consulting engineer in Lexington, Kentucky, has been appointed professor of ore dressing at the Technical University of Bandung, Indonesia.

Michael A. Kuryla, of Lima, Peru, has been elected a vice president and director of Cerro de Pasco Petroleum Corporation, a newly organized, wholly owned subsidiary of Cerro de Pasco Corporation (New York). Mr. Kuryla will assume his new duties in addition to continuing responsibilities as assistant manager of the Lima division of Cerro de Pasco Corporation (Delaware).

Philip P. Powers, former chief mine engineer for the Dulaney Mining Company of Grand Junction, Colorado, has accepted a position with the Andes Copper Mining Company (subsidiary of The Anaconda Company) in Potrerillos, Chile.

Ralph D. Williams is now vice president of Lake Asbestos of Quebec Limited, and **William R. Whitener** is the company's new sales manager. Since 1951, Mr. Williams has been in charge of sulphuric acid and SO_2 sales and operations, with headquarters at Salt Lake City. He will continue his duties concerning the marketing of Garfield Chemical and Manufacturing Corporation's production. Mr. Whitener has been purchasing agent for Fibreboard Paper Products Corporation since 1950. New York will be the headquarters for both men.

Samuel R. Milbank, partner of Wood, Struthers and Company, has been elected a director of the New York and Honduras Rosario Mining Company to fill the vacancy left by **Maximiliano F. Soto**, deceased.

Sir M. Turner, a director of Rio Tinto Company Ltd., has been on a tour of inspection of the company's interests and operations in the Union of South Africa and the Central African Federation.

D. R. Blair and **J. Ward Allen** have been named to the board of directors of Cariboo Gold Quartz Mining Company of Vancouver, British Columbia, Canada.

Dr. Edward Warner, president of the Council of the International Civil Aviation Organization in Montreal, Canada, has been named the first honorary member of the International Society of Aviation Writers at ISAW's first general meeting in Washington, D. C. in April. The honor was given to Dr. Warner "in recognition of a lifetime of inspiring leadership and devoted effort in the cause of internationalism, civil aviation, aeronautical education, and professional aviation writing."

Dr. Toni Hagen stopped in Delhi, India recently on his way home to Switzerland from Nepal, where he has been making a geological survey since 1950 to assess the country's mineral and other resources. The work was begun by a Swiss team and is being completed by the United Nations. Dr. Hagen has completed about 95 percent of the survey and will return to Nepal in September to finish the job.

H. K. Brown has left his position with Minas da Urgeirica, Canas de Senhorim, Portugal, to become Commissioner of Mines at Kingston, Jamaica, British West Indies.

Robert Fowler, explosives technician for the E. I. du Pont de Nemours & Company, Inc., in Denver, Colorado, recently visited mines in Chile to check blasting practices and also stopped in Argentina and Brazil.

John Harper, concentrator superintendent of Chibuluma Mines, Kalulushi, Northern Rhodesia, recently returned from Australia where he visited several mining operations.

Aubrey Finn, concentrator superintendent for Mufulira Copper Mines, Mufulira, Northern Rhodesia, has returned from a tour of inspection of concentrator operations in the United States and Canada.

R. F. Goodwin has been elected president of the Peruvian-American Association, Inc. to succeed **Henry J. Seesselberg**, now president of Wessel, Duval & Company, Inc. Mr. Goodwin is chairman of the executive committee of the Southern Peru Copper Corporation. Prior to his present association he spent 35 years with American Smelting and Refining Company, the last nine years as vice president in charge of the mining department. He has served as director of the Association since 1947. **Frank F. Russell**, chairman of the board of Cerro de Pasco Corporation, and **Robert D. Merrill**, vice president of All America Cables and Radio, Inc., continue as vice presidents of the Association. New vice president is **Ralph E. Kimpel**, vice president of the Guaranty Trust Company of New York. **William B. Hughes**, manager of direct sales division of the United States Steel Export Company, and **P. E. Sibilia** were reelected treasurer and secretary, respectively.

American Smelting and Refining Company has made several changes in the top management jobs: KENNETH C. BROWNELL (left) has moved up from president to chairman of the board; R. WORTH VAUGHAN (center), former executive vice president, takes over as president; and OSCAR S. STRAUS (right), who has been vice president and treasurer, was elected chairman of the finance committee. Mr. Brownell joined ASARCO in 1927 in the ore purchasing department and after several promotions became executive vice president in 1947 and president in 1949. Mr. Vaughan first became associated with the company in 1937 as assistant general counsel. He was appointed vice president and general counsel in 1947 and executive vice president in 1955. R. D. BRADFORD, president of Lake Asbestos of Quebec Limited, a subsidiary, and a vice president of the parent company, was named a management director. FORREST G. HAMRICK, assistant to the chairman of the finance committee, was also named treasurer and director. KERSHAW HARMS, general manager of the Federated Metals Division, was named a vice president. ROGER W. STRAUS, board chairman, and JOHN C. EMISON, finance committee chairman, both are retiring, but Mr. Straus will remain a director.

Announcing HI-CAP*...

New Du Pont Explosive

designed for economy in blasting operations

Hi-Cap . . . the newest addition to the Du Pont explosive family . . . will assure economy in many blasting operations.

The reason is simple. Hi-Cap answers the demand for a low-priced, cap-sensitive, water-resistant explosive with high strength for all-around shooting.

Hi-Cap is available in 12½ and 25 lb. bags for pouring into small diameter dry holes and in 23-G cartridges of 5" diameter and above.

When Hi-Cap is poured in small diameter holes, a 40% dynamite primer, 1¼x8, is recommended for detonation.

For maximum safety, charges of Hi-Cap should be detonated with Primacord in the usual manner using Du Pont MS delay connectors whenever practical. With this method of firing, you have no blasting caps on the job until the shot is ready to fire.

Notice how the 23-G cartridge is crimped to facilitate loading in the hole. The tape bail serves as a carrying handle, and also for lowering. Since no outside case is required for the 23-G cartridge, there is no packing material or debris left to clean up after the shot is loaded.

Call your Du Pont representative for more information on low-priced Hi-Cap or write: E. I. du Pont de Nemours & Company (Inc.), Explosives Department, Wilmington 98, Delaware.

**Registration applied for.*

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BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

How To Figure Metal Prices From English Currency

As MINING WORLD readers well know, the quotations on metals and certain ores carried in this section each month are furnished through the courtesy of *The American Metal Market*, New York, New York. This is the industry's leading metal quotation service with daily listings. The following description of the use of English Currency is an answer to an *American Metal Market's* reader request. It is reproduced here because many MINING WORLD readers desire and will use the same information.

"Every now and then a subscriber requests that we quote English metal prices in U.S. Currency. In the interest of accuracy, English courrency must be used, since the U.S. equivalent is subject to the movement of the different exchange rates. In the English Metal Prices table, which appears on this page, we have, however, indicated the approximate closing prices, in U.S. dollars, based on the fixed parity of exchange, $2.80 to £ 1.

"For the convenience of those who may be interested in making approximations of other prices, a simple 'rule of thumb' conversion may be made by dividing the number of pounds Sterling (and decimals thereof) by eight. Thus, £ 240 per long ton works out at 30¢ per pound and £ 240 30-1/16¢. This short cut in converting prices per long ton (the unit of trad- is possible only at the parity rate of ing on the London Metal Exchange) 10s—or £ 240½—becomes 30.0625¢ or $2.80 per £ 1 presently in effect.

"If precise values are desired, however, the prevailing cable and/or futures exchange rates (there are several) should be obtained through a financial instiution. These rates are always subject to momentary fluctuation, and in recent years have oscillated between $2.82 and $2.78 per £ 1 for the basic cable rate."

CORRECTION

Through an unfortunate printing error, the production of mercury in Japan in 1956 was erroneously given as 26,200 flasks in the MINING WORLD Yearbook, page 68. The correct figure is 6,200. Sincere apologies to the author, J. Eldon Gilbert, who supplied the correct figures.

U.S.A. Metal & Mineral Prices

METALS

		May 21, 1957
COPPER:	**Electrolytic.** Delivered F.o.b. cars, Valley basis	32.00¢
	Lake. Delivered, destinations, U.S.A.	32.00¢
	Foreign Copper. Valley basis	32.00¢
	Custom	31.00¢
LEAD:	**Common Grade.** New York	15.00¢
	Tri-State Concentrates, jig, flotation 80% lead, per ton	$184.00
ZINC:	**Prime Western:** F.o.b. E. St. Louis	11.50¢
	Prime Western: Delivered, New York	12.00¢
	Tri-State Concentrate, 60% zinc, per ton	$68.00
ALUMINUM:	**Primary 30 Pound Ingots (99% plus).** F.o.b. shipping points	27.10¢
ANTIMONY:	**Lone Star Brand.** F.o.b. Laredo, in bulk	33.50¢
BISMUTH:	(In ton lots) price per pound	$2.25
CADMIUM:	**Sticks and bars.** 1 to 5 ton lots (Price per pound)	$1.70
COBALT:	**97.99%,** keg of 550 pounds (Price per pound)	$2.00
COLUMBIUM:	**Powder** Nom., per pound	$120.00
GERMANIUM:	**Germanium:** dioxide, high purity, gram	24.00¢
LITHIUM:	**98%** (per pound)	$11.00-$14.00
	Carbonate	82.00¢
MAGNESIUM:	**Ingots (99.8%)** F.o.b. Valasco, Texas, per pound	36.00¢
MERCURY:	**Flasks.** Small lots, New York	$255.00-$257.00
NICKEL:	**"F" Ingots (5 pounds).** F.o.b. refinery, Port Calbourne, Ontario	74.00¢
SELENIUM:	**99.5%,** per pound	$13.50-$15.50
THORIUM:	per kilogram	$43.00
TIN:	**Grade A Brands.** New York (Price per pound) Prompt delivery	98.25¢
TITANIUM:	**99.3%** + Grade "A" Sponge (Price per pound)	$2.75
URANIUM:	**Nominal,** per kilogram	$40.00
U-235:	**Nominal,** per kilogram	$11,000.00
GOLD:	**United States Treasury Price**	$35.00 per ounce
SILVER:	**Newly mined domestic.** United States Treasury price	90.5¢
	Foreign Handy Harmon	91.37¢
PLATINUM:	**Per Ounce**	$92.00-$95.00
ZIRCONIUM:	**Sponge, Per Pound,** Nominal	$10.00

ORES AND CONCENTRATES

BERYLLIUM ORE:	**10 to 12% BeO.** F.o.b. mine, Colorado	$46.00 per unit
	Small lot purchases at Custer, S. D., Spruce Pine, N. C., and Franklin, N. H. Visual inspection at $400.00 per short ton or by assaying at: 8.0 to 8.9% BeO, $40 per unit; 9.0 to 9.9%, $45; over 10.0%, $50.	
CHROME ORE:	F.o.b. railroad cars eastern seaports. Long tons dry weight.	
	African (Rhodesian). 48% Cr_2O_3. 3 to 1 Ratio	$56.00-$57.00
	African (Transvaal). 48% Cr_2O_3. No Ratio	$40.00-$41.00
	Turkish, 48% Cr_2O_3. 3 to 1 chrome-iron ratio	$60.00
	U. S. Government ore purchase depot Grants Pass, Oregon, Base price, lumpy ore, $115.00; fines and concentrates $110.00 for 48% Cr_2O_3 and a 3 to 1 chromium-iron ratio. Premiums for higher grade are and for a ratio up to 3.5 to 1. Penalties for grades down to 42% Cr_2O_3.	
COLUMBIUM-TANTALUM ORE:	At United States small lot beryl purchase depots. $3.40 per pound contained combined pentoxides in 50% ore. Includes 100% bonus. (Government stopped buying temporarily May 12)	
	Per Pound Pentoxide.	$1.15-1.35
IRON ORE:	**Lake Superior. Per gross ton Lower Lake Ports**	
	Mesabi, Non Bessemer, 51.5% Fe.	$11.45
	Mesabi, Bessemer, 51.5% Fe.	$11.60
	Old Range Non Bessemer.	$11.70
	Old Range Bessemer.	$11.85
	Swedish, Atlantic Ports, 60 to 68% Fe. Contracts, Per Unit	28.00¢
MANGANESE ORE:	**Metallurgical grade.** 48 to 50% Mn. Long ton unit	$1.50-$1.55
	Metallurgical grade. 46 to 48% Mn. Long ton unit	$1.40-$1.45
	Metallurgical grade. 44 to 46% Mn. Long ton unit	$1.35-$1.40
	Domestic U. S. Government ore purchasing depots: Butte, Montana; (black and pink ores) base price of $4.87 per lona dry ton of 18% manganese ore. Phillipsburg, Montana; base price of $6.43 per long ton of 15% manganese ore. Small lot program f.o.b. railroad cars, minimum 40% Mn. Base price (48%) $2.30 per unit with premiums and penalties.	
MOLYBDENUM CONCENTRATE:	**90% MoS_2 F.o.b.** Climax, Colorado. Per pounds of contained molybdenum, plus cost of containers	$1.10
TUNGSTEN CONCENTRATE:	**Domestic.** 60% WO_3 Per short ton unit	$55.00
	Foreign. 65% WO_3 Per short ton unit (Scheelite)	$27.00
	Foreign. South American, Spanish, Portuguese	$20.00
URANIUM ORE:	**Carnotite-Roscoelite.** F.o.b. purchase depot plus $0.06 per ton mile ($6.00 maximum), Grand Junction, Rifle, Durango, Naturita and Uravan, Colorado. Salt Lake City, Marysvale, Thompsons, Moab, White Canyon, Green River, and Monticello, Utah. Shiprock, and Grants, New Mexico, Edgemont, S. Dakota, Riverton, Wyoming, Tuba City, and Cutter, Arizona. Base price for 0.10% ore is $1.50 per pound and up to $3.50 per pound of contained U_3O_8 plus $0.75 per pound for each pound in excess of 4 pounds per short dry ton and an extra allowance of $0.25 per pound for each in excess of 10 pounds. A $0.50 per pound development allowance paid on all ore purchases. Special lime schedule applies at Monticello, Moab and Grants. No lime penalty with no vanadium payment or lime penalty with vanadium payment.	
VANADIUM ORE:	**Carnotite-Roscoelite.** V_2O_5 in ratio of more than 10 parts to 1 part of U_3O_8 are generally acceptable at all AEC depots, but excess not paid for at Marysvale, Monticello, and Bluewater. Shiprock has no limit on V_2O_5 to U_3O_8 ratio and all contained V_2O_5 is paid for Per Pound V_2O_5	$0.31

NON-METALLIC MINERALS

BENTONITE:	**Minus-200-mesh.** F.o.b. Wyoming points. Per ton in carload lots	$12.50
	Oil Well grade. Packed in 100 pound paper bags	$14.00
FLUORSPAR:	**Metallurgical grade.** 70% efective CaF_2 content per short ton F.o.b. Illinois-Kentucky mines	$40.00
	Mexican. 70% F.o.b. border	$24.00-$24.50
	Acid Grade. 97% CaF_2, Bulk, F.o.b. Kentucky, Illinois, Colorado	$55.00
	Government buying F.o.b. producer's shipping point: 60% Illinois-Kentucky, $34.50 per ton, others $28.50; 70% Ill.-Ken. $38.50, others $32.50.	
PERLITE:	**Crude:** F.o.b. mine per short ton	$3.00 to $5.00
	Plaster grades. Crushed and sized. F.o.b. plants	$7.00 to $9.00
SULPHUR:	Long ton, F.o.b. Hoskins Mound, Texas	$25.50
	Export	$30.50

LONDON METAL AND MINERAL PRICES

			May 21, 1957 Per Long Ton	USA Equivalent cents per pound[1]
COPPER:	**Electrolytic spot**	£236	10s 0d	29.56¢
LEAD:	**Refined 99%**	£ 94	10s 0d	11.81¢
ZINC:	**Virgin, 98%**	£ 82	5s 0d	10.28¢
ALUMINUM:	**Ingot, 99.5%**	£197	0s 0d	24.625¢
ANTIMONY:	**Regulus, 99.6%**	£222	10s 0d	27.81¢
TIN:	**Standard, 99.75%**	£764	0s 0d	95.50¢
TUNGSTEN:	**Long ton unit**	150$		$21.00
		With Sterling pound at $2.80.		

Quotations on metals and certain ores through the courtesy of *American Metal Market, New York, N. Y.*

PRODUCTION EQUIPMENT PREVIEW

PEP is just what new equipment, increased mechanization, and new methods can give to your mine, mill or smelter. This PEP section is MINING WORLD's way of making available to you some of the finest current information on mechanization.

Portable Sump Pump By Schramm Resists Corrosion

A new corrosion resistant, self-contained portable sump pump has been announced by Schramm, Inc. The pump, featuring heavy duty thrust and radial bearings, non-clogging impeller, and stainless steel shaft, requires no priming. Only 19¾-inches high, the pump can be passed through a hole a small as 9-by 11-inches. Solids over ¾-inches are blocked out by an integral bronze strainer. Pump speeds vary between 3200 and 3600 rpm, depending upon head and air pressure. Capacity and air consumption vary. At 60 psi, pumping against a 10-foot head, the unit consumes 57 cfm and has a capacity of 234 gpm. At 100 psi, pumping against a 50-foot head, the pump consumes 97 cfm and has a capacity of 168 gpm. Circle No. 55 for additional information.

DTR Bits Have Strongest Diamonds in Key Bit Area

The diamonds which do the bulk of the drilling job in a diamond bit are the I.D. and O.D. corner stones and the stones on the leading cutting edges next to the waterways according to the manufacturer, Diamond Tool Research Co., Inc. DTR bits have the strongest and largest stones set in these key areas to give the last bit of cutting action out of every diamond.

Further information on DTR bits is contained in a new catalog giving specification for coring bits, casing bits, concave bits, reaming shells, etc., as well as prices. If you are using diamond bits, you will want a copy of this new catalog. Circle No. 60.

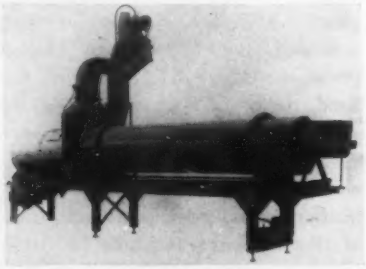
Motorized Sled For Fast Over-The-Snow Transport

The Eliason motor toboggan, featuring automatic clutch and transmission and ability to perform snow tasks previously accomplished only on skis, snowshoes, or dog team, is now in production by the Four Wheel Drive Auto Company. The sled is capable of towing loads of up to 1,000 pounds, depending on snow conditions, and will operate for hours on its self-contained fuel supply at speeds of 5 to 25 mph. Its only controls are an automotive-type steering wheel and hand throttle. The toboggan is driven by an endless, cleated track which is forced into snow by the pressure of the power unit on the track, which is spring loaded for shock protection. Two steering skis mounted on the under-surface of the toboggan runners provide a turning radius of approximately 12 feet. Circle No. 78 for further information.

M-R-S Tractor Features Hydraulic Weight Transfer

The M-R-S Manufacturing company announces the availability of a four-wheel drive version of the 335 horsepower M-R-S 200 Tractor. Designed for hauling over rough terrain, the driving front axle combines a high degree of mobility with a large amount of traction made possible by hydraulic weight transfer. Hydraulic weight transfer gives additional traction to the rear wheels by hydraulically transferring weight from the unit being hauled.

Weighing 45,500 pounds, and having large low-pressure tires, the big tractor is capable of providing a maximum tractive effort of 44,100 pounds. The M-R-S unit is recommended as a prime mover to self-load scrapers up to 20 cubic yards struck capacity, and for powering scrapers up to 39 cubic yards heaped capacity when loaded with pusher assistance. Circle No. 59 for more information.



Dual-Flow Rotary Dryers Announced by Carpco

A compact and reliable dryer for efficient handling of granular material without loss of fines has been announced by Carpco Manufacturing Inc. Carpco Dual-Flow dryers feature a concentric fire-tube design which causes the gases to travel the full length of the dryer before making contact with the feed. This prevents any direct flame impingement and allows indirect heating by radiant means, with direct heating by hot gases only. The entire system is maintained under slight negative pressure by means of labyrinth seals and a positive displacement feeder.

Two models are presently available, with a capacity of one and two tons per hour of bone dry product. Circle No. 56 for free bulletin and additional information.

Australian Subsidiary Established by A-C

Allis-Chalmers Mfg. Company, Milwaukee, has established a new wholly owned subsidiary in Australia, the Allis-Chalmers Australia Pty. Limited, and through it has purchased the assets of Thomas C. Pollard Pty., Limited, Newcastle. The plant will continue to make motor graders, and will expand production to other construction machinery. Land has been purchased for expansion.

VALVE WITH ARMOR SEAT: The new Jenkins Plug Type valve features a stainless steel valve seat with a Brinell hardness of 500, for use where abrasion, entrapped pipe chips, scale or rust particles are a problem. Send for the free Jenkins catalog on their complete line of valves. Circle No. 1.

ELECTRONIC ROAD MAP: Flying by means of an "electronic road map," helicopters can now operate in remote areas completley on instruments as a result of a research program by Bell Helicopter Corporation and Bendix Aviation Corp. The system uses transmissions of radio signals from the ground and receiving equipment in the aircraft. For additional information circle No. 2.

PERMANENT MAGNET Plate and Prong Separators are now available from the F. W. Shrader Co. These magnets can be installed over belt conveyors for tramp iron removal, or the vertical prong type may be installed in chutes or hoppers where the flow of material is too deep to be affected by the plate type magnet. For additional information and brochure, circle No. 3.

RESISTO-LOY COMPANY, well known manufacturers of build-up and hard-surfacing rod, in April announced that it has never been company policy to offer any experimental or unproven alloy products to the industry. The company's well known "Resisto-Loy", "Manga-Tone, N.M.", "Chro-Mo-Loy", "Isorod" and "Two-Tone, T.H.", find wide application in the mining industry. They are proven products developed and offered only after substantial research and testing. For further information on the advantages of the above mentioned products, circle No. 4.

CRAWL-IR: The Ingersoll-Rand Company have developed a new, knee-action crawler wagon drill called the "Crawl-IR." This unit is completely mechanized, having five hydraulic cylinders allowing it to be set up in almost any drilling position by finger-tip control. Mounted on crawler tracks, this self-propelled unit is capable of towing its own compressor. Write to the company at 11 Broadway, New York 4, N.Y., for additional information.

ERRATIC FEED PROBLEMS? If you have problems with underfeeding or overfeeding, you will be interested in obtaining further information on Syntron's "Vibra-Flow" Vibratory Feeder. "Vibra-Flow" feeders provide a smooth even flow of bulk materials—hot or cold, dry or damp, from powders to chunks. For further information on the "Vibra-Flow," circle No. 49.

List information you want MINING WORLD to obtain for you on this card. WE'LL DO THE REST. No postage necessary if mailed in U. S.

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Also send further free information on the equipment advertised on pages:

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PINCH VALVES: 10-page folder on Massco-Grigsby Rubber and Neoprene Pinch Valves for corrosive and abrasive pulps and liquids. Gives complete engineering specifications and data on service recommendations in the mining industry. Write to The Mine & Smelter Supply Co., 3800 Race St., Denver, Colorado.

MULTIPLE HEARTH Furnace literature is now available from the Nichols Engineering & Research Corporation. This informative bulletin describes the Nichols Herreshoff Multiple Hearth Furnaces which feature uniform temperatures to 1800° F., rigid atmosphere control, gas solids contact, high heat transfer coefficient, zoned gas flow, zone temperature control, and other important points as well. Circle No. 37 for your copy.

CUSTOM-BUILT Hydraulic Cylinders are now available from the Benton Harbor Engineering Works, Inc. These cylinders feature compactness, efficiency, and close tolerances. Minimum mounting space is required, and there is no tooling charge for cylinders built to meet your specifications. Circle No. 38 for additional information.

RADIAL LOAD capacity increased on new variable speed and gear motors. Sterling Electric Motors, Inc., have recently developed new Slo-Speed gear motors, and Speed-Trol variable speed motors up to 15 hp, and with speeds from 20 rpm to 350 rpm. Developed for severe radial duty, by extending distances between bearings on output shafts, the motors are ideal for agitator drives, conveyor drives, and for mountings where excess machine clearance is desirable. Circle No. 39 for additional information.

ROPE BELT CONVEYOR: Goodman Manufacturing Company have recently developed a new type belt conveyor which is suspended on wire rope, instead of on frames as is the case with conventional types of conveyors. Recent tests of a 4000 foot installation using 48-inch wide belting, showed that costs of the installation were ⅓ less than using a conventional type of conveyor, also belt costs were considerably less as a lighter ply belt could be used as the resiliency of the rope belt conveyor absorbs load impact at carrying idlers. Circle No. 40 for additional information.

WESTERN HEMISPHERE MINERALS are completely described in Senate Document 83, 84th Congress. It is a complete report by Senator George Malone's Minerals, Materials, and Fuels Economic Subcommittee. It contains a very complete summary of the resources and economics of all the nations in the Western Hemisphere and should be of considerable interest to many engineers. Obtain your free copy by addressing the Committee on Interior and Insular Affairs, United States Senate, Washington, D. C.

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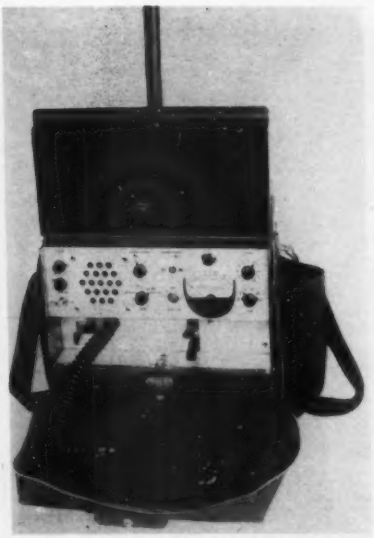
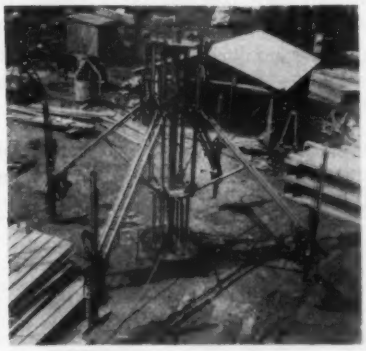


Portable Radiotelephone Designed for Field Work

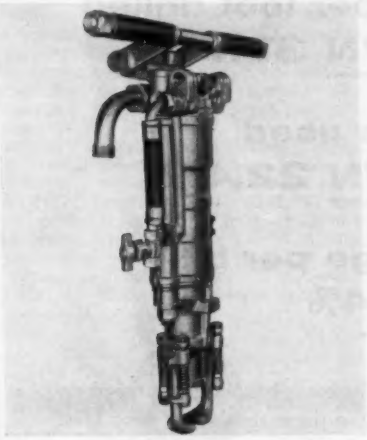
A new portable AM radiotelephone developed to handle field communications in mining is the newest item in Kaar Engineering's line of communications equipment. Called the TR 246 Packset, this new, small, rugged radiotelephone is designed to provide reliable field communications in areas where terrain features make the use of VHF equipment impractical. Entirely self-contained in a water-tight canvas backpack, the Packset can be operated and carried at the same time. Measurements are 12-inches by 6-inches by 11¾-inches, and the unit with batteries weights 23 pounds. Circle No. 57 for additional information.



New Shaft Sinker Has Air Motor Feeds, Boom Control

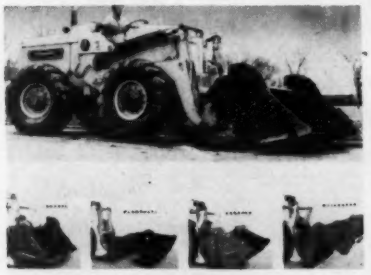
A new shaft sinker with air motor feeds and air motor controlled booms is now available from the Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin. The shaft jumbo, called the SDR, is available with a choice of two, three, four, or six booms and six different drills.

The SDR sinker has a centralized oiling system and needs only one master air line from top-side down to the shaft to the top of the sinker unit. Individual air hoses to the drills are securely attached to the boom, eliminating any interferences with drilling operations. Maximum drilling area is 26 feet, when arms are extended. The sinker coses to 11½ feet, but drills can be toed-in to drill next to the four-foot diameter pedestal. Height of the SDR is 18½-feet. Further information may be obtained by writing to the company at the above address.



Shock-Absorbing Handle For Le Roi Rock Drills

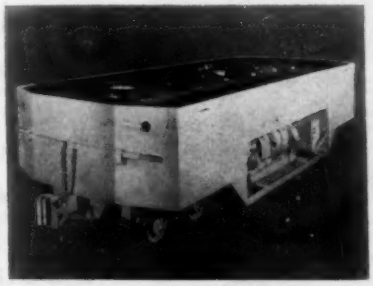
New shock-absorbing handles for use with Le Roi-Cleveland hand held rock drills are now available. Designed to absorb recoil and vibration, the new handles reduce operator fatigue, resulting in more efficient operation and higher output. Vibration is absorbed by rubber cushions incorporated into the mechanism of the new handle. Handle adjustment can be made to suit operator's desired degree of vibration dampening. The new handles are now standard equipment on the H-10, H-12, and H-111 sinker drills. Modification kits are available for other models. Circle No. 53 for complete information.



Payloader Available With "Four-In-One" Attachment

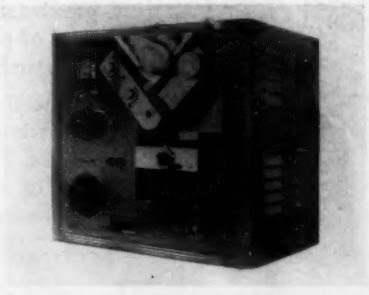
The Frank G. Hough Co., has recently announced that the entire line of four-wheel-drive "Payloader" tractor-shovels will now offer Drott "4-in-1" buckets as optional equipment. This attachment can be used as a shovel, clamshell, scraper, or as a bulldozer.

As a conventional tractor-shovel bucket it can be used to dig, carry and dump in the regular manner. As a clamshell, the clamshell action can be used to clean up small piles, pick up material without tractor travel, or to grasp and handle stumps, pipe, timbers, etc. Used as a scraper with slight clam-lip opening it becomes a carry-all scraper that heaploads itself, carries and spreads thin lay- with hydraulic fingertip blade-pitch control to regulate dozing depth and to discharge sticky material. Circle No. 52 for additional information.



M-S-A Develops A New Underground Fire Truck

A new, highly mobile mine fire truck has been produced by Mine Safety Appliances Company, for swift delivery of a water "payload" with volume and pressure sufficient to combat underground fires. The model 2100, has a capacity of 2,100 gallons of water, and motor and pump assembly to deliver heavy streams as desired. The truck is a compact, low-slung unit, which can negotiate a No. 2 turnout with ease. It has standard eight roller bearing wheels with five-inch tread for extra maneuverability, and carries 200 feet of single conductor cable on a reel at the rear of the tank. Motor pump assembly, including controls and valves, is recessed in the side of the tank for ease of hook-up and maintenance. For further information circle No. 54.



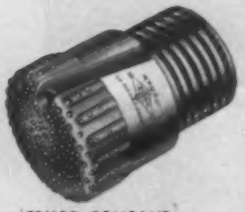
New Magnetic Separator For Lab and Pilot Plant

A compact, versatile high intensity induced roll electro-magnetic minerals separator, designed expressly for laboratory and production control or development, has been announced by Carpco Manufacturing, Inc. Designated Model M-12, the unit can handle feed rates as high as two pounds per minute and comes equipped with an especially designed potentiometer and circuit which allows continuously variable control of the magnetic flux from zero to full saturation of the magnetic components.

Although designed to operate on 110-115 volts DC, the unit is furnished with rectifiers for use on 110-115 volts AC. With a transformer operation on 220-230 volts, 50/60 cycle AC is possible. Circle No. 56 for additional information.

DRILLING COSTS HIGH? *Read this—*

TRUCO CORING BIT



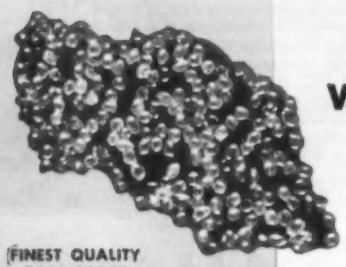
TRUCO CONCAVE BLAST HOLE BIT

TRUCO PILOT BIT

TRUCO IMPREGNATED CORING BIT

TRUCO REAMING SHELLS

TRUCO STANDARD OIL FIELD BIT



FINEST QUALITY DRILL BORTZ

Cost per ton for drilling DOWN 66%

Cost per foot drilled DOWN 37.7%

Carats used DOWN 22.4%

Footage per bit UP 54%

Random purchase of diamond bits proved extremely costly in the early days of long blast hole drilling in limestone at The Warner Company's Bell Mine, Bellefonte, Pa. So, tests were conducted to provide data for bit performance analysis.

The analysis showed that the pilot type, non-coring bit delivered highest footage, highest diamond salvage and lowest cost per foot drilled. It also indicated the advantages of working with *one* manufacturer in developing a bit tailor-made to the job. The Truco bit was adopted and developed through progressive stages of improvement to the present level of performance which is remarkable by any standards.

One Truco bit had drilled 27,560 feet of hole when it was taken out of service to be studied. That footage is exceptional but footages of 10,000 to 12,000 feet per bit are not uncommon.

27,560 FEET WERE DRILLED *by this Truco bit before it was retired from service for study*

These studies have been continuous and cover type of bit, carats per bit, diamonds per carat, carats used per bit, salvage per bit, footage drilled per bit, bit cost, cost per foot drilled and cost per ton. They are, therefore, complete and factual and the information they yield has paid off. If you'd like to have a more detailed report of these studies, we'll be glad to send you a copy.

And, if drilling costs are your responsibility, maybe you should talk to the Truco Diamond Drill Bit man. Very likely he can help you.

Year	Footage Per Bit	Carats Used Per Foot Drilled	Salvage	Cost Per Foot Drilled	Cost Per Ton
1st	3630	.00089	67.7	0.0122	.0065
2nd	4930	.00085	68.1	0.0111	.0041
3rd	4300	.00084	69.6	0.0110	.0032
4th	5590	.00069	67.7	0.0076	.0022
	UP 54%	DOWN 22.4%		DOWN 37.7%	DOWN 66%

TRUCO DIAMOND BITS

by

WHEEL TRUEING TOOL COMPANY

3200 W. Davison Avenue, Detroit 38, Michigan

WHEEL TRUEING TOOL CO. OF CANADA, LTD.
575 Langlois Avenue, Windsor, Ont., Canada

Anaconda To Work Copper Properties in Washington

The Anaconda Company is planning work at two optioned copper properties in the Cascade range of King County, Washington, this season.

A diamond drilling program is scheduled at the 10-claim Western States Copper and Uranium Corporation mine on Quartz Creek, 16 miles northeast of North Bend, from which some shipments of concentrate have been made to the Tacoma smelter in recent years.

A geological survey is to be completed at the 50-claim prospect of United Cascade Mining Company 26 miles up the Middle Fork of Snoqualmie River from North Bend and 2½ miles north of Snoqualmie Pass. Anaconda built a 2½-mile road to the property from Goldmyer Hot Springs.

Charles Sisenvine of Seattle is president of Western States Copper and Uranium Corporation. United Cascade is owned by M. F. Gilbreath, D. D. Gilbreath, and W. L. Gill, all of Seattle. E. C. Stephens is the geologist in charge of Anaconda's northwest exploration office in Spokane.

A $165,000 development project is planned by *Clayton Silver Mines* at its Custer County, Idaho property to extend the main shaft 280 feet and open a new working level at a depth of 800 feet. Most ore has been mined out above the 400-foot level but reserves mineable from the new 500 level are estimated to be sufficient for capacity milling of 3,000 tons monthly for the next four to six years. Norman M. Smith is general manager.

Bradley Mining Co. is selling remaining property at its antimony mine, mill, and smelter at Stibnite, Idaho because of what management called "very inadequate" tariff protection for domestically produced antimony. The operation, started in 1932, once produced nearly one-third of domestic requirements for the metal. James Bradley of San Francisco is vice president.

William and Roscoe Derr of Clark Fork, Idaho, have leased part of the nearby property of *Hope Silver Lead Mines, Inc.*, and started shipments of crude ore to the *Bunker Hill* smelter at Kellogg. Glenn C. Lee of Kennewick, Washington is company president, and L. P. Larson of Coeur d'Alene, secretary-treasurer.

A contract for construction of a $7,500,000 phosphate rock processing and calcium metaphosphate manufacturing plant at Georgetown Canyon, Bear Lake County, Idaho, has been let to *Jacobsen Construction Company* of Salt Lake City. The contract is part of a $14,500,000 mining, processing, and manufacturing project planned by *Central Farmers Fertilizer Company*, a Chicago cooperative. The rock processing plant is scheduled to go into operation by December 1 and the calcium metaphosphate plant in October 1958. Strip mining of phosphate rock is scheduled to begin this summer. Joseph L. Lanter is president of the cooperative.

A $16,000 copper exploration project is being undertaken on the *Copper Camp* leases in Valley County, Idaho by *Highland-Surprise Consolidated Mining Company*. The DMEA-approved project calls for 80 hours of bulldozing and about 1,600 feet of diamond drilling. Frank J. Luedke, Spokane, is company president.

Sunshine Mining Company expects to complete by midsummer facilities for producing refined antimony from cathode antimony by removal of arsenic. The antimony plant is at the firm's Sunshine mine in the Silver Belt, Coeur d'Alene mining district, Shoeshone County, Idaho. A formal offering has been made to General Services Administration for delivery of between 1,500 and 2,000 tons of grade B antimony to the national stockpile over a two-year period. A comprehensive geological study of the *Sunshine* mine is being made by E. N. Pennebaker of Scottsdale, Arizona, who is a consulting geologist.

Rehabilitation of the old *Snowshoe* lead-zinc-silver-gold mine south of Libby in northwestern Montana has been resumed by *St. Paul Lead Company* and *Merger Mines Corporation* after a winter shutdown. Work done last season disclosed about 30,000 tons of ore and negotiations are under way for a selective flotation plant. A. L. Osborn is president of St. Paul Lead and C. H. Hunter of Hayden Lake heads Merger.

The *Northern Mining Company* will operate the Hawkeye mine and 50-ton-per-day gold mill near Landusky, Montana in the new future. Work was completed on the mill last fall but operations were suspended at the mine for the winter.

Officials of *Castle Lead and Zinc Company* at Lennup, Montana plan to continue exploration work in the old *Yellowstone* mine in the Castle Mountain district of Meagher County, Montana, after July 1. Present plans call for extension of the adit into the old workings of the mine.

Minerals Engineering Company and its affiliated *Salt Lake Tungsten Company* have reopened one mine, the mill and refinery for production of tungsten. The Minerals Engineering mines and mill near Glen, Montana were closed in March, along with Salt Lake Tungsten's refinery in Salt Lake City, Utah. According to company management, resumption of operations has been made possible by the recent discovery of 300,000 to 500,000 tons of tungsten ore at the *Calvert Creek* or *Red Buttons* property northwest of the mill at Glen.

Western America of Montana, a wholly owned subsidiary of *Alscope Explorations Ltd.* of Edmonton, Alberta, Canada, reportedly has blocked out 11,860 tons of silver-lead-zinc ore in the *Morning-Midnight* mine. The firm is to spend $150,000 in development work. The properties are located near Basin, Montana.

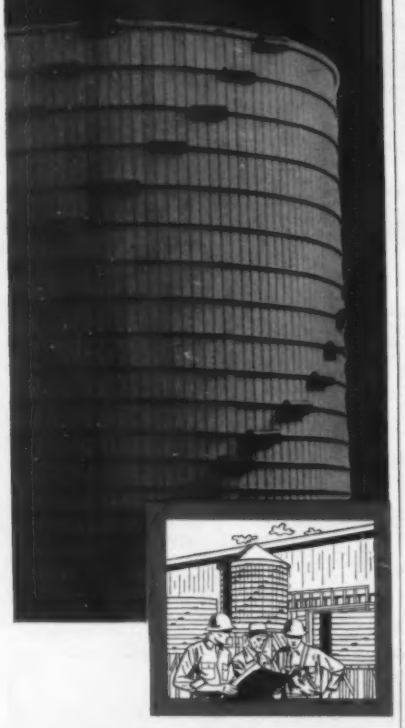
Erection of a 100-ton selective flotation mill is planned by *Montana Standard Mining Company, Ltd.* at its silver-lead-zinc mine near Thompson Falls, Sanders County, Montana. Deepening of the shaft 200 feet also is planned. Loy L. Vose is president.

Pryor Mining Company expects to have full-scale mining underway this summer at its *Old Glory* uranium mine in the Pryor Mountain-Little Mountain area on

Daybreak Mines and Stockpiles Uranium Ore

This is a general view of mining and stockpiling operations of Daybreak Uranium, Inc. at its principal open-pit mine in the Mount Spokane district of northern Spokane County, Washington. Bulldozers and power loaders stockpile autunite in medium-grade, high-grade, and low-grade piles shown in the foreground from left to right. Daybreak has stockpiled nearly $1,000,000 worth of uranium ore at its Dahl lease, and expects to have at least $200,000 worth on hand when the uranium processing plant at Ford, Washington goes into operation early in August. The company recently started exploration of the nearby Ingram lease obtained from Affiliated Mines, and is sinking a development shaft on its uranium deposit in the Spokane Indian Reservation of Stevens County. Kae H. Sowers of Opportunity is secretary-treasurer, and H. W. Norman is geologist and manager of mining and exploration.

WOOD TANKS
NO CORROSION
NO RUST



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NORTHWEST

the Montana-Wyoming border. Discovered in the fall of 1955, the mine has produced only 5,000 tons of ore through January 15, 1957. According to Charles M. Hauptman of Billings, geologic consultant, the average uranium content was 0.63 percent. The ore is taken to the AEC buying station at Riverton. Discoverers of the deposit were George Guay and Leo Eres of Billings, and Corwin Rule and Ben Helgeland of Pryor.

Midas Minerals, Inc. expects to have its phosphate fertilizer plant in operation this summer. The plant is located about 15 miles south of Drummond, Montana, and is being built at a cost of about $200,000. Several large phosphate deposits are reported to be in Drummond area, and would supply the plant. The company intends to mine, mill, and market the product.

OREGON

Wah Chang Corporation has officially dedicated its new zirconium plant at Albany, Oregon, reportedly thus becoming the world's second commercial producer of reactor grade and commercial grade zirconium metal. The company already operates another zirconium plant in Oregon—the U. S. Bureau of Mines' Electro Experimental Station. In May 1956, the Atomic Energy Commission appointed Wah Chang operator of this facility. Shortly thereafter, Wah Chang purchased a 60-acre tract on the north side of the city and started construction of the new plant.

Lakeview Mining Company, operating the *White King*, and *Lucky Lass* uranium leases, near Lakeview, Oregon, has petitioned the Atomic Energy Commission for permission to erect a 210-ton uranium mill at Lakeview. Exploration at the White King has proven satisfactory and a two-compartment shaft is being sunk.

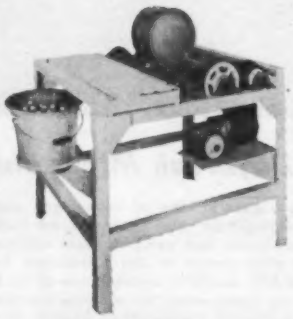
WASHINGTON

Dawn Mining Company's $3,500,000 uranium processing plant at Ford, Stevens County, about 50 miles northwest of Spokane, Washington, is scheduled to start operations early in August. At last report, the main building was virtually completed and machinery was being installed. Some machinery had been installed in the adjacent crushing plant and concrete walls were going up around the machinery. A large custom ore slab was down, a scale house completed, an assay laboratory under construction, and a large tailings pond being scooped out. The mill will have a daily capacity of 400 tons of ore. Dawn is a subsidiary of *Newmont Mining Corporation*, and *Midnite Mines, Inc.* has a minority interest. Most of the ore will be provided by Dawn's Midnite mine in the Spokane Indian Reservation. The plant also will process the first uranium ore from Alaska, now being mined by *Kendrick Bay Mining Company*, a subsidiary of *Climax Molybdenum Company*, at Ketchikan.

The old *Pacific Mutual Silver Lead Company* property near Keller, Ferry County, Washington, has been leased by *General Uranium, Inc.* of Spokane. A preliminary geological examination has been made and additional work is planned to determine whether the property can be returned to production. Some silver-lead-zinc-copper-gold ore was shipped in the '20s by the predecessor *Addison Copper Company*. J. L. Simpson of Coeur d'Alene, Idaho, is president of General Uranium.

Pacific Silica Company, which has been operating near Deer Park, Stevens County, Washington, for a number of years, has started a new silica mining operation at the William Diedrich farm in the Cottonwood district, southeast of Chewelah, Stevens County. Shipments are to be made from Valley, where a loading ramp has been constructed at a Great Northern siding.

Geo-Resource Corporation of Spokane, formerly *Mine Consultants, Inc.*, has discontinued consulting services to the industry in order to concentrate on projects in which it has interests. The firm is planning to do about $87,000 worth of drilling on ground leased from *Grandview Mines* north of the Spokane Indian Reservation, Stevens County, Washington, to check on a uranium ore deposit indicated by surface soil sampling. William D. Weaver is president.



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Hidden Splendor Acquires Control of Rio De Oro

A controlling interest in Rio De Oro Uranium Mines, Inc. with headquarters in Albuquerque, New Mexico has been acquired by Atlas Corporation through its wholly-owned uranium subsidiary, Hidden Splendor Mining Company. Hidden Splendor will have over 40 percent of the outstanding stock of Rio De Oro, as well as certain "underlying interests" in one of the ore bodies, and will operate the mining properties.

Rio De Oro is the only firm mining uranium ore in the Ambrosia Lake area north of Grants, New Mexico. The Company has two substantial ore bodies in the area from which it has mined and sold about 20,000 tons of ore.

Rio De Oro is also participating in the construction of a 750-ton uranium mill near Grants as a member of Homestake-New Mexico Partners. The mill is to be managed and operated by Homestake Mining Company, using ore furnished by Rio De Oro.

Since the first of this year Rio De Oro has purchased 1,460 acres of land from Columex Uranium Corporation, and has assumed the mineral leasing rights for a 460-acre tract of land owned by Yucca Uranium, Inc. Both properties are in the Ambrosia Lake area.

W. Rodney DeVilliers, president of Rio De Oro and one of the original founders, has agreed for the present to continue as president.

Climax Molybdenum Company at Climax, Colorado has completed two engineering projects which are designed to increase working efficiency. First installation is molybdenum sulfide bulk loading scales and conveyor which is expected to save over $18,000 a year. With this new system, molybdenite is fed into a screw-type conveyor from three bins, instead of into buggies. As the concentrate travels to the freight car, it is automatically sampled and weighed. Second new installation is the addition of a package boiler to the steam plant which will supply additional power for several sections of the camp.

The Bureau of Land Management has been making field examinations in the Disappointment, Gypsum, and Paradox Valley areas east of Dolores River and south of San Miguel River in San Miguel and Montrose counties, Colorado, under Public Law 167.

Delhi-Taylor Oil Corporation reports that its exploration work in the area north of Moab, Utah, has revealed large reserves of potash. Reserves sufficient for operation of a 1,000-ton-per-day plant for a 41-year period have been estimated on the company's holdings. Studies are now being made of railroad rates, since proper rates are essential to the success of any large project in this area. The company has completed a preliminary shaft pilot hole to a depth of 611 feet and plans to sink a second hole before shaft sinking is started.

A uranium ore body has been found at the *Ransom* mine near Blanding, Utah, under development by *Sunshine Mining Company*, northern Idaho silver producer. It was found on the *Avalanche* claim, about one-half mile from two other deposits and is yielding about 20 tons of ore daily from development headings.

A cinnabar discovery has been reported on state school land in the old Free Coinage mining district of the Stansbury Mountains in Tooele County, Utah. Three Grantsville men, Sterling Halliday, Earl Flinders, and Eugene Anderson, operating on a lease from the state, made the find. Two pods or ore were exposed in a fissure in limestone and a "float" suggests that a third pod may be found within 1,000 feet. Assays of surface samples yieleded from 0.16 to 0.72 percent mercury.

Petty Mining Company is doing core drilling for the *Atlas Uranium Corporation* on its Piccolo Pete properties in the White Canyon area of San Juan County, Utah. The work is being done under a $73,603 DMEA contract.

New Park Mining Company is diamond drilling the property of *Silver Standard Mining Company* in the Ophir district of Tooele County, Utah. The two firms have a 10-year exploration agreement with calls for drilling and drifting off a 1,000-foot tunnel in exploration for lead-zinc ores.

The *Denver and Rio Grande Western Railroad* is building a spur to the *Union Carbide Nuclear Company's* upgrading plant now under construction at Green River, Utah. The railroad name of the new junction will be Ucarn. All of the spur cannot be completed until the company installs ore bins between the mill and the rail line. Steady progress is also being made at Union Carbide's second upgrading plant at Slick Rock in San Miguel County, Colorado. This plant is to be finished late this summer; *Catalytic Construction Company* of Philadelphia has the contract. The main source of the ore for this plant is new mines in Burro Canyon. The shafts for the *Burro Canyon No. 3. No. 5*, and *No. 7* are already sunk and are being operated for Union Carbide by the *LaSalle Mining Company* of Grand Junction, Colorado. Most of the ore will be stockpiled until the concentrator is completed.

Royal Uranium Corporation, operating its Indian Creek district properties in San Juan County, Utah, reports that it has completed recovery of its presently known ore reserves and is now drilling its other claims in the district. About 6,000 tons of 40 percent ore still remain in the original workings. The firm has also exercised its operation to acquire eight claims near Rock Springs, Wyoming which it will drill.

Utah Construction Company, which was founded in Ogden, Utah about 50 years ago, has decided to move its official headquarters to Delaware. The transfer will be made through a merger with a Delaware firm having the same name, management, assets, and business and financial standing.

An engineering department crew from the *Union Pacific Railroad* is making a survey of the 60-mile branch line to serve the proposed *Atlantic City* iron ore development of *Columbia-Geneva Division, U.S. Steel Corporation*, near Lander, Wyoming. The nine-man crew, headed by H. B. Durant, is working in the South Pass area where some difficulty has been found in crossing Willow Creek Draw near the historic pioneer gold mining camp of South Pass City. A long earth fill or trestle may be required. The survey is to provide a cost estimate for construction of the branch line. Cost of this line would be a factor in determining whether Columbia-Geneva will proceed with development of the deposit. Meanwhile, iron ore from the South Pass area has been sent to Minnesota for test purposes. The sample was mined by *Centennial Development Company* from a 700-foot adit that the latter has been driving into the hillside on Columbia-Geneva's prospect.

Reynolds Minerals Corporation, a subsidiary of *Reynolds Metals Company*, has extended its option for another year on the coal and water belonging to the John Rice estate at Lake DeSmet near Buffalo, Wyoming. The company is proceeding with an extensive coring and testing program. Work also will continue at the proposed power and aluminum plant site during the summer. Last October Reynolds exercised its option and purchased the W. B. Lott coal property on the west side of the lake for a reported $500,000. The vast coal deposit and ample water supplies are expected to make the site an excellent location for an aluminum reduction plant.

Lucky Mc Uranium Corporation has filed application for patents on 89 uranium claims in the Gas Hills with the Bureau of Land Management office in Cheyenne, Wyoming. The application is reportedly the first filed for patents on uranium claims in Wyoming, and could easily be the largest group of claims ever filed in any land office at one time.

Phelps Dodge Corporation has drilled an additional 10,000 feet more than required under its option agreement with *Wyoming Uranium Company*. The property being tested is in the Crooks Gap area of Fremont County, Wyoming. Under the original agreement, Phelps Dodge was to drill not less than 68,000 feet, and could extend the drilling another 14,000 feet if desired. Phelps Dodge did this, and also drilled another 10,000 feet by April. If Phelps Dodge decides to take over the property, a new company will be formed with 49 percent of the stock held by Wyoming Uranium and the remaining 51 percent by Phelps Dodge.

Regular shipments are being made from the Wyoming open-pit mine of *North American Uranium Inc.* of Jamestown, North Dakota. In six months, the firm shipped 25 carloads of carnotite averaging 0.22 percent uranium oxide to the processing mill at Edgemont, South Dakota. Drilling reportedly indicates a second ore body in the area which will be investigated further.

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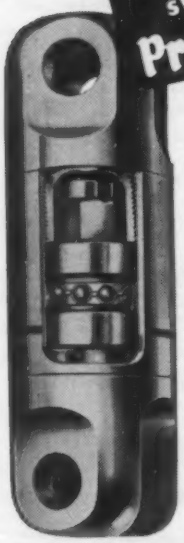

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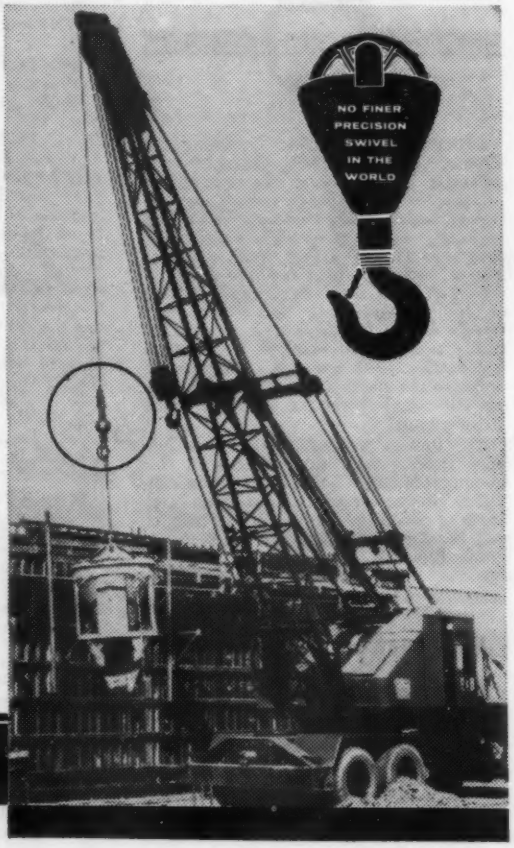

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Union Carbide To Dredge for Florida Titanium; Du Pont Will Manage and Operate Two Plants

Union Carbide and Carbon Corporation will use a converted western gold dredge to recover titanium mineral concentrates from sands of Amelia Island off Florida's east coast. Union Carbide will use the rutile and ilmenite concentrates to produce titanium sponge at the largest United States titanium plant at Ashtabula, Ohio. It is the only sodium reduction plant in the United States and produces 7,500 ingot tons of sponge annually.

Number 1 on the accompanying map shows the location of Union's 3,000 acres of leases where an exploration program has been underway by the Union Carbide Ore Company during the last two years. Dredgeable reserves of heavy minerals (3.0 percent by weight) were developed during the exploration campaign. Ilmenite, rutile, zircon, and monazite are the commercially valuable minerals in the heavy mineral group.

Union will use a reconverted and rebuilt 9-cubic-foot, connected, bucket-line gold dredge for mining. It has been known, heretofore, as the Waterford dredge of Yuba Consolidated Gold Fields and formerly dug placer gold near Waterford, California. The dredge has a pontoon-type hull which will facilitate shipment and rebuilding. This is the first use of this type of dredge for mining Florida beaches. However, Marine Minerals Corporation operates one in South Carolina.

Some 500 tons of beach sand will be dug per hour and heavy minerals recovered by jigs. The concentrate will be transferred ashore and trucked to a dry mill where the minerals will be separated by electrostatic and magnetic separators. Washed sand tailing will be stacked at the dredge's stern, levelled, and the area replanted.

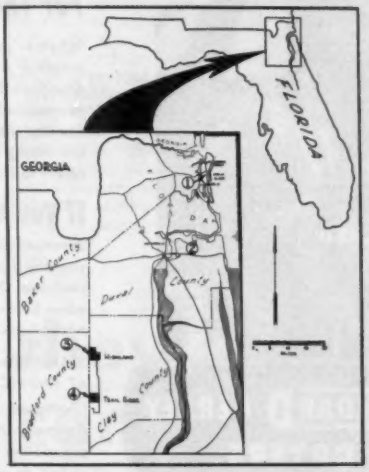
Number 2 on the map is the location of Humphreys Gold Corporation's Jacksonville titanium minerals operation which has been producing for a number of years. In 1944 Humphreys installed the first spiral plant in Florida here to recover these titanium minerals. The plant has been expanded and has been operated continuously by Humphreys for the Rutile Mining Company. Feed has ranged between 4.0 and 8.0 heavy minerals, about one half of which are salable.

In 1949 Humphreys placed in operation the Trail Ridge plant for E. I. duPont de Nemours & Company, located at Number 4 on the map. This was the first operation in Florida to use a barge-mounted Humphreys spiral plant for concentration.

In the spring of 1955 Humphreys started the new Highland plant for duPont, Number 3 on map. This is the largest and most modern Florida plant and has an output of 100,000 annual tons of titaniferous minerals concentrate. A cutter head suction dredge is used for mining, with concentration by spirals on one large "wet mill" floating barge.

In mid-1955 duPont purchased the mineral rights in the area between the Highland and Trail Ridge plants and has since dredged some of this ground.

Humphreys and duPont have now issued a joint announcement that Humphreys' 10-year management and operational contract for these two plants will end in mid-February 1958. DuPont will retain all but a few key Humphreys employees and will operate the plant itself after that time. DuPont officials report



they have been most appreciative of the Humphreys organization, and that the change in management is for closer integration of intercompany operation with greater economies thus possible.

Kennecott Copper Corporation's exploration subsidiary, Bear Creek Mining Company, was very active in the area several years ago but has abandoned field propects without acquring any minerals rights, according to reports.

Lead-Zinc Surplus Grows; Hope for Increased Uses

Major hopes for the lead and zinc miners are in new uses and expanded markets for their metals if the current high production and oversupply situation is not to be increased. This was the consensus of industry participants in the joint meetings of the Lead Industries Association and the American Zinc Institute in Chicago, Illinois in late April.

Richard H. Mote, chief, Branch of Base Metals, U. S. Bureau of Mines, estimated that world production of slab zinc in 1957 should reach an all-time high of 3,141,000 short tons, an increase of 59,000 tons over the 1956 output. Lead production is estimated at 2,328,000 short tons, an increase of 27,000 tons, he said.

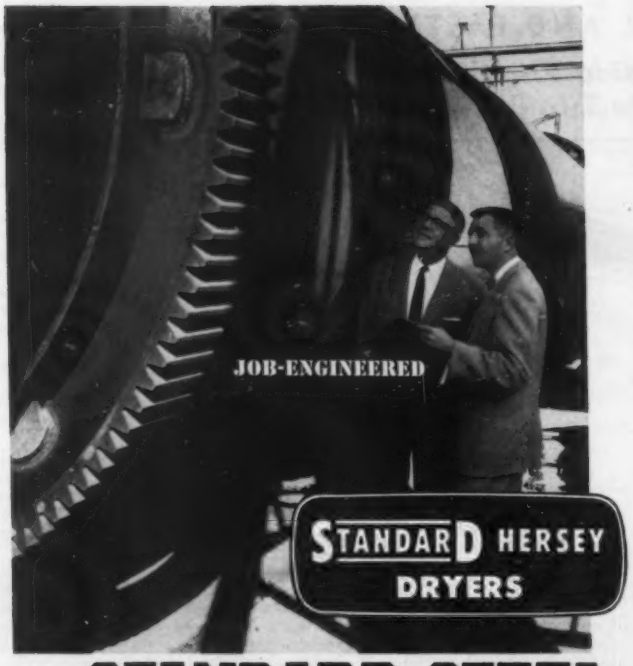
According to Dr. Joseph Zimmerman, editor in chief, *The Daily Metal Reporter*, the recent tapering off of lead and zinc demand is simply a continuation of the leveling off of the 1955 business boom. He noted that consumers of lead and zinc have greatly reduced their inventories and some of them are down to a 30-day supply. This means they aren't going to be able to stay out of the market indefinitely, he said. Meanwhile the government's policy on stockpiling together with its exercise of the farm barter program is the controlling factor on zinc prices, he stated.

Lead and zinc consumption in relation to production, and efforts being made to increase production, were outlined by R. Hendricks, vice president of sales. The Consolidated Mining & Smelting Company of Canada, Ltd. He noted with some concern that consumption of zinc lagged behind production. Although such world surpluses are being withdrawn from the market for government stockpile, he considered this an unhealthy situation and called on the industry to do "practical, applied research designed toward improving present applications of zinc, making them more economic, and developing new uses which will be competitive with other materials." He cited as examples of such research the production of unusually pure alloys for zinc anodes used for cathodic protection, as well as a current program being pursued by the Mines Branch of the Department of Mines and Technical Surveys in Ottawa, Canada on die casting alloys based on high purity commercial zinc to which controlled amounts of various impurities are added.

As for lead, Mr. Hendricks said that although lead is currently being consumed at a greater rate than new reserves are being discovered, this is a situation which could quickly reverse itself if passenger cars should turn to the use of fuels not requiring high octane gasoline. New major uses of lead are not being developed fast enough, he warned. "If we are to increase consumption to balance production . . . the producers of lead and zinc must engage in extensive research individually, in cooperation with each other, and in cooperation with consumers, not only to develop important new uses for lead and zinc, but to improve the natural advantages which these metals have in present applications."

Calumet & Hecla Inc. plans to completely mechanize the billet handling system at its smelter in Calumet, Michigan so that billets will no longer require manual handling. Reason for the change is the fact that the smelter will be supplying larger billets to the Detroit plant of the Wolverine Tube Division (8-inch instead of 3-inch), and a completely mechanized handling procedure is necessary for these larger pieces. Conversion work is to start in July. Calumet's mining division has abandoned some of the working areas in *No. 3 Ahmeek* because of danger of rock bursts. All levels below No. 37 have been abandoned on the south side of the shaft, and all levels below No. 41 on the north side. All equipment on the No. 43 and 44 levels has been moved to higher levels. At the company's *Caledonia* exploration project at Greenland, Michigan, cross cutting to the Butler and Evergreen lodes is almost completed. Eight lodes, all potentially ore-bearing, are accessible.

Current conditions in the zinc industry have forced *Eagle Picher Company* to close down all of its zinc mining and smelting operations in the Tri-State area of Missouri, Oklahoma, and Kansas. Company-held inventories have been "creeping up" in recent months to a point where production is exceeding consumption. A. Rockwell, vice president, said operations would be resumed when market conditions permit. The decision meant unemployment for 1,100 employees in the



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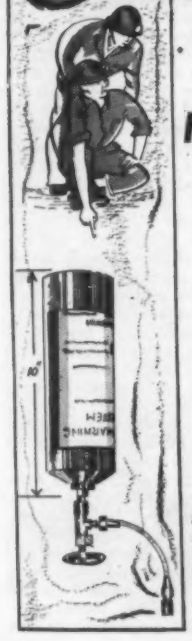

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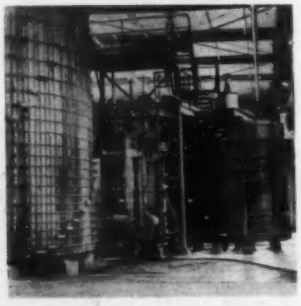

Windeler tanks handle acid solutions economically. Pictured here are three Windeler Built Tanks in a South Dakota uranium mill handling various solutions. At the left is an ion exchange feed (highly acid, pH 1.7) holding tank, large tank at right is a slime tailing neutralization tank, and the small one in the center is a lime slurry tank.

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Picher and Henryetta area of northeastern Oklahoma and about 60 percent of the mining and milling operations. It also will affect 300 additional men employed by independent mining companies which ship ore to the Central mill of Eagle Picher near Cardin in Ottawa County, also closed.

An ore preparation plant will be built by *Union Carbide & Carbon Corporation* at Warwick, Virginia. To be operated by the *Union Carbide Ore Company*, a division of the parent firm, the plant will process manganese and chromium ore from various parts of the world. It will grade and classify about 30,000 tons monthly. Unloading facilities will be able to handle full ocean cargoes of ore at a rate of about 500 tons per hour. The ore then will be shipped by rail to another Union subsidiary, *Electro Metallurgical Company*, for use in production of alloys.

To stress the importance of the basic concepts of surface and physical chemistry in an understanding of the flotation process and to show the relationship between basic research on flotation and the more practical aspects of this operation, a one-week course in Physical Chemistry of Flotation will be given at the *Massachusetts Institute of Technology* at Cambridge, Massachusetts from July 8 through July 12. Among the guest lecturers from industry will be: H. Rush Spedden, director of research, *Union Carbide Ore Company*, New York; George E. Atwood, manager, *Duval Sulphur and Potash Company*, Carlsbad, New Mexico; Charles H. G. Bushell, research engineer, *The Consolidated Mining and Smelting Company of Canada*, Ltd., Trail, British Columbia; William A. Griffith, mill superintendent, *The New Jersey Zinc Company (Bertha Mineral Division)*, Austinville, Virginia. Dr. Douglas W. Fuertenau, section leader, minerals and chemical engineering group, *Electro Metallurgical Company*, Niagara Falls, New York. Tuition is $175.

International Minerals & Chemical Corporation is currently redesigning and rearranging its Noralyn washer in order to provide greater efficiency and versatility of performance. The work should be completed shortly, at which time it is expected to yield a better, cleaner pebble product, handle any type of matrix, and provide a higher output. Included is rebuilding of matrix distributors and trommels, adding variable speed drives on log washers, adding two new trains of flat screens, installation of new hammer mills and finishing screens. The project is part of the company's phosphate program at Bartow, Florida.

Cleveland-Cliffs Iron Company has announced expansion plans for doubling the capacity of the *Humboldt* and *Republic* mines and plants in the near future. CCI is the major shareholder and operating manager of these projects which officially are owned by *Humboldt Mining Company* and *Marquette Iron Mining Company*. Among the possible beneficiation practices planned is the reduction roasting process using rotary kilns. The deposits are specular hematite which have been treated by froth flotation during past and present mining operations. CCI is also building an ore improvement plant which will be located adjacent to the Eagle Mills pelletizing plant of Marquette. The plant will treat ore from underground mines of CCI on the Marquette Range. The plant is to increase iron content of regular ores by a combination of moisture reduction, crushing, screening, and lowering the silica content. At the company's *Mather* "A" mine, a unique 3,700-foot belt conveyor is being installed which is expected to permit the lower operating levels of the mine to come into production in a shorter length of time at minimum cost.

Hanna Coal and Ore Corporation is developing the *Musser* mine, formerly *Section 33*, this year. Located three miles north of Crosby, Minnesota, it covers 40 acres and is part of the *Cuyuna* group. About 1,200,000 cubic yards of overburden must be removed before the property is brought into production. It is expected to be producing in 1958, with ore treated at the nearby Maroco plant.

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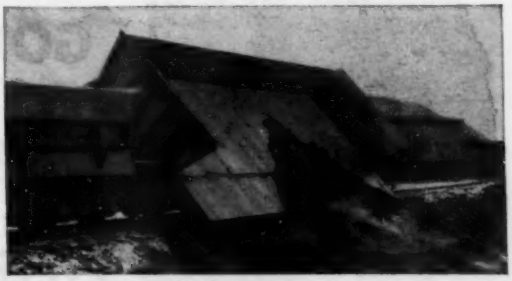

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Duval Sulphur Signs Letter Of Intent For Copper Mill

Duval Sulphur and Potash Company has signed a letter of intent which contemplates that the company will contract for the construction of a 10,000 ton per day copper-molybdenum flotation mill.

Duval has been exploring its Pima County property since March of 1955. Explorations to date consist of 34 diamond drill holes totaling 12,376 feet in depth, 49 churn drill holes totaling 17,093 feet in depth, and an adit from which run 1,576 feet of drifts and crosscuts and 450 feet of raises and winzes. On October 15, 1956, estimates of proved ore reserves were: 14,665,000 tons of higher grade ore with an average copper content of 0.77 and molybdenum content of 0.0197 per cent, and 34,150,000 tons of ore with an average copper content of 0.60 per cent and molybdenum content of 0.0216 per cent. Removal of about 5,000,000 tons of overburden from one to 250 feet thick will be required before production can be started.

The company proposes to develop and equip property for open-pit production at an estimated rate of 10,000 tons of ore per day, with start of production scheduled for the latter part of 1959. Cost of the development and equipment program is estimated at $20,000,000, of which $950,000 has already been expended.

Duval has initiated proceedings for patenting a group of 90 lode claims in the Twin Buttes district of Pima County, about 25 miles southwest of Tucson, Arizona. Robert Lenon, U. S. Mineral Surveyor of Patagonia, Arizona, has the survey assignment. According to Duval, the 90 unpatented claims cover 1,730 acres under which are the entire proved ore reserves. The remainder of the company's unpatented claims, covering 2,090 acres, are not considered patentable at this time.

Duval is engaged in the mining and marketing of crude sulphur and the mining, refining and marketing of potash. In 1956, potash accounted for approximately 70 percent of the company's total net sales in dollars. Main offices are located in the Esperson Building, Houston, George F. Zoffman, president and general manager. B. G. Messer is engineer in charge of the copper-molybdenum development at Tucson.

Rare Metals Corporation of America is negotiating with the United States Atomic Energy Commission for an amendment in its contract to increase the treatment allowance of its Tuba City, Arizona plant from 260 tons per days to 400 tons per day. If the increase is permitted, the company plans to spend $350,000 on an expansion of the plant. Mining operations on the *Arrowhead-Ramco* uranium properties near Cameron, Arizona increased known reserves by approximately 5,500 tons of ore. Drilling on other lands covered by an exploration permit on the Navajo Indian Reservation in Arizona have developed an estimated additional volume of 10,000 tons of uranium ore.

A decision to defer for the present the start of sinking the production shaft and the construction of principal plant units at the *Christmas* mine near Winkelman, Arizona, has been announced by *Inspiration Consolidated Copper Company*. According to Richard S. Newlin, president of Inspiration, additional time is needed to perfect the company's knowledge of the mine and the mining and treatment problems presented by its ores. In place of the 10,000,000 tons of 2 percent ore with an estimated recoverable copper content of 360,000,000 pounds originally reported, Inspiration now estimates the O'Carroll Bed reserve at the Christmas mine at 16,000,000 tons of 1.8 percent ore with a recoverable copper content of about 518,000,000 pounds. Newlin said the increased tonnage and the lower grade have created the twin problems of higher initial investment in both mine development and treatment plant, and higher ultimate operating costs per pound of copper. Metallurgical experience with Christmas ores is to be gained through operation of existing concentrator on a small scale, then incorporated in the design of the new mill.

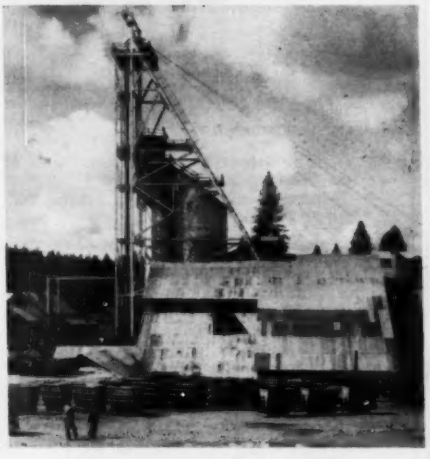
Reclaiming of the 2,200-foot Pratt tunnel at the old *Troy* property, near Ray, Arizona, is being handled by the *Universal Copper Corporation* of Tucson. James E. Gaylor, president, reports that the work has been in progress since last June and that he expects to reach first of three large ore bodies shortly. The Pratt tunnel connects with the old *Alice* mine at the west end of the Troy and was a producer of high-grade copper ore at the turn of the century.

Miami Copper Company, Miami, Arizona, in March of 1957 put into operation one section of an enlarged and modernized precipitation plant. This plant is used to recover copper from in-place leaching of previously mined areas of the *Miami* mine. To increase copper production from this sources, a second section of the precipitation plant will be required, together with improvements and additions to the underground pumping plant, and this work is scheduled to start soon. Approximately 17 percent of the division's copper comes from in-place leaching, and production of low-cost copper by this method is expected to continue long after cessation of underground mining operations. Miami estimated that its mineable ore reserves on January 1, 1957, totaled 12,840,000 tons.

The *Copper Cities Division, Miami Copper Company*, Miami, Arizona, in 1956 produced 55,264,337 pounds of copper from the open-pit mining of 4,167,147 tons of ore with a copper content of 0.795 percent. In addition, 388,304 pounds of copper were recovered from precipitates produced at the Burch water treatment plant, where certain of the company's industrial waters are treated before being used. Overburden stripped in 1956 totaled 3,869,132 tons, resulting in a waste-to-ore ratio of 0.93 to 1.00. Approximately 9,500,000 tons of ore, proved by drilling during the year, were added to the ore reserves, thereby increasing the total to 36,600,000 tons although the addition slightly lowered the average grade of the reserves.

Production from the *Ray Mines Division, Kennecott Copper Company*, Ray, Arizona, in 1956, totaled 53,248 tons of copper, compared to 48,983 tons in 1955. This production was obtained from the 5,852,742 tons of ore mined by open-pit methods and containing 18.1 pounds of copper per ton, the lowest grade of ore handled in Ray's history. In 1955 the ore mined contained 21.1 pounds copper per ton. Kennecott reported that the installation begun in December 1955 for increasing by 12 percent the amount of copper recovered from the ore of the Ray division is completed and ready to be placed in operation, and that construction of the new smelter is underway. The latter plant is scheduled for completion in 1958.

Last Grass Valley Gold Mine Shuts Down



On March 15, 1957 the last cage of men was hoisted from the Brunswick Mine of the Idaho Maryland Mines Corporation, caps were put on the shaft, and the main power switch was pulled. For the first time in over 100 years no gold is being produced in the Grass Valley district. Since World War II spiraling costs have exceeded contents of the ore to such an extent that it was not feasible to continue operations. The first workings of the present Idaho Maryland Mines Corporation started in this area in 1863. It has had its ups and downs since then hitting the peak of its production in the 30's when as many as 1000 men were employed. It has a record production in excess of $70,000,000. The company plans to retain its mineral rights and strategic surface holdings and, if possible, to diversify the company's activities. Idaho Maryland along with several other gold mines has a claim against the government for damage sustained during the L208 shutdown order during World War II. The government has appealed the case to the Supreme Court and it is expected the case may be heard during the fall term. The picture above of the Brunswick headframe and mill building was taken on the last day of operation. Two small boys look over some of the equipment that was brought up from the now silent mine.

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Inspiration Consolidated Copper Company, Inspiration, Arizona, reports that tests have indicated the feasibility of recovering minor amounts of molybdenum as a byproduct in the course of concentration of Inspiration ores. Additional metallurgical experimentation is to be undertaken at once and, if successful, will be followed by the installation of the required flotation and other equipment. Capital cost, it was stated, would be modest. Because of market conditions, present production at Inspiration has not been increased to employ the full capacity of the new dual-process installation which began operation in January. Also, some production has been cast into anodes and stored at the plant to await refining in the company's own electrolytic tank house, operation of which has been delayed because of slow delivery of essential equipment. Full operations are not expected until the end of June.

The *Leturno Asbestos Corporation*, operating in the Young area of Arizona, is reported to have completed its asbestos mill. Trial runs are said to be in progress to perfect the milling procedure.

The *Eagle-Picher Company* has sold its *San Xavier* mine and mill, located south of Tucson, Arizona, to the *McFarland and Hullinger Company*, of Tooele, Utah. Announcement of the sale was made by Grover J. Duff manager of Eagle-Picher in Tucson. F. G. McFarland and S. R. Hullinger have been leasing and working the San Xavier mine for the last two years. Currently, they are employing 32 men at the mine and 7 at the mill at Sahuarita. W. D. Nelson is in charge of operations at the mine and K. L. Erickson, formerly of Henderson, Nevada, is mill superintendent.

Dasco Mines Corporation, Alfred Morgan, manager, Wenden, Arizona, has started the construction of a manganese mill about one-quarter of a mile northeast of Wenden. According to reports, the plant, using straight flotation, will have a daily capacity of 200 to 250 tons. Ore for the plant will come primarily from the *Doyle* mine, located about 26 miles north of Wenden. During the manganese purchasing program at the Wenden Depot, the Doyle was leased to *Stovall Manganese Company* which produced approximately 75,000 tons of ore averaging 16.1 percent manganese. Dasco proposed to up-grade the product to meet specifications for shipment under the government's carload program for manganese. Harriison Doyle and Robert N. Doyle, of Vista, California, are president and vice-president, respectively, of the corporation.

The *Montana* lead-zinc-silver mine at Ruby, Arizona, has been purchased by the *Matador Oil Company* and the *Maravilla Minerals Corporation*, a privately owned mining company, according to an announcement by Manford Susman, president of Matador. The deal covered 15 patented claims and six unpatented claims, the camp site with eight buildings, and a schoolhouse. The new owners state that a milling plant with a daily capacity of 125 tons will be erected immediately, and that extensive exploration of the area will be conducted by diamond core drilling. The Montana mine was purchased from Hugo W. Miller of Nogales, Arizona, who has operated the mine intermittently since acquiring it from the *Eagle Picher Company* in the early 1940s.

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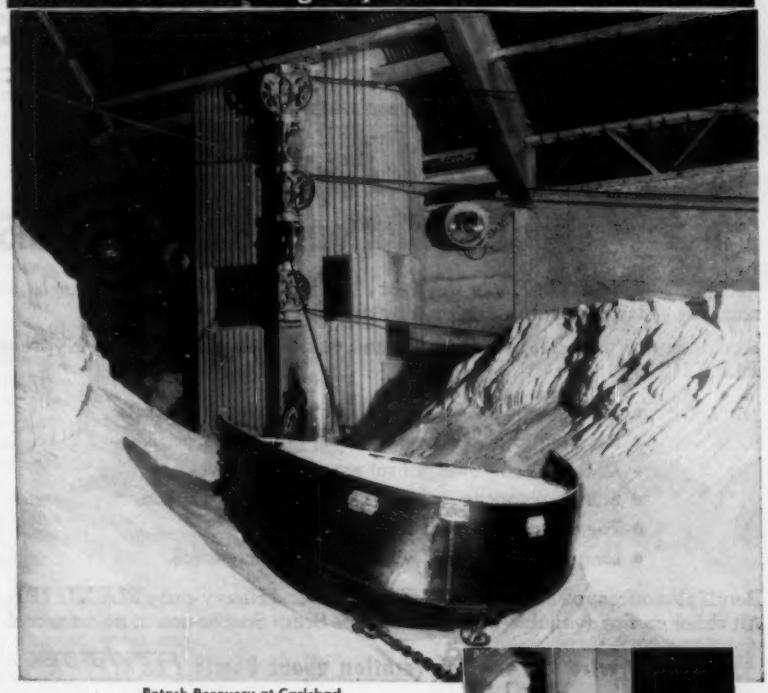

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SOUTHWEST

CALIFORNIA

United States Borax and Chemical Corporation has reached the main borate ore body at its new open-pit mine at Boron, California. Tincal ore was reached at a depth of 137 feet, after more than 7,000,000 tons of overburden had been removed. Mine developments and plant construction are proceeding on schedule and production should begin toward the end of this month. The mine is operated by the *Pacific Coast Borax Division.*

Kaiser Steel Corporation's limestone deposit at Cushenbury, California has begun producing, with first shipments already delivered to the firm's steel mill at Fontana. Until now, the company had been purchasing needed limestone from commercial quarries in Nevada. At the company's *Eagle Mountain* iron ore beneficiation plant, further additions are being made which will increase shipping grade of the ore from about 56 percent to about 60 percent iron content. The long-range exploration program is continuing. Last year two new claims were validated by core drilling.

Coso Uranium Inc. expects to complete the second phase of its exploratory drilling program on its property in Inyo County, California this month. The first, completed in April, indicated the presence of a large, low-grade deposit containing an estimated 800,000 tons of 0.055 percent U_3O_8. Consideration was being given to installation of an upgrading plant.

The *Western* borax mine operated by *California Borate Company* has shut down its operations after 2½ years of development work. The property had been a former borax producer which then had laid idle for a number of years. The *Mudd* interests of Los Angeles acquired it in 1955, formed the company mentioned above, and began reconditioning and unwatering it. A headframe and hoist were erected in anticipation of production from the Number 3 shaft.

Great Lakes Carbon Corporation has consolidated its dicalite and perlite divisions into the newly organized *Mining and Mineral Products Division.* This reorganization is expected to provide maximum efficiency and economy of operation. D. Loring Marlett, vice president of the company and formerly general manager of the dicalite and perlite divisions, will be general manager of new division. Administrative headquarters will be located in Los Angeles. Principal offices of the company are in New York City.

Recent exploration work by *Palo Alto Mining Corporation* of San Jose, California has paid off in higher production from its *Guadalupe* mercury mine in Santa Clara County. The company purchased the lease on the property in the fall of 1955. First prospecting was centered around the old Kelley workings, and then last year exploration was concentrated on a northwest extension of the mine, now known as the North Ridge area. Five surface pits and an adit have been opened along this extension. Production for the year was reported to be over 900 flasks.

NEVADA

American Potash and Chemical Corporation has started production of decaborane in its pilot plant at Henderson, Nevada. This is the first known commercial facility for producing decaborane, a high-energy chemical compound of boron and hydrogen, and is the newest in a long list of boron chemicals being offered by the company. Decaborane is highly reactive and, on burning, generates approximately 28,000 Btu of heat per pound. Although most of the output is being used to meet existing sales commitments, limited quantities are offered for sale for investigational purposes by industry.

White Caps Gold Mining Company is pumping out the old *White Caps* mine shaft near Manhattan, Nevada in preparation for resumption of mining. Plans are to reopen the 800-foot level to a crosscut directly over the ore body and diamond drill for extensions. The deposit was located in a winze on the 1,300-foot level, and showed high-grade ore. Recent development work on the 300-level located antimony and quicksilver. The company plans to lease, on a split-check system, all area above the 800-foot level.

Consolidated Eureka Mining Company, operating a lead-silver-gold mine in the Eureka district of Nevada, has been sinking a winze which serves the 400 and 500 levels down to the 600 level where a station has been cut. Drifting from this station is underway to reach the downward projection of the ore body. A raise was also driven to check the possibility of the ore zone going above the 320 level.

Copper output increased considerably at *Kennecott Copper Corporation's* open-pit operation in Nevada during 1956. The Liberty pit produced 2,124,357 tons compared with 1,773,449 in 1955; the Veteran produced 424,605 tons compared with 67,157 in 1955; and the Kimbley produced 1,393,232 tons compared with 1,353,400 in 1955. During the year stripping at the Liberty totaled 645,651 tons, compared with 1,241,847 in 1955; 8,607,488 tons were stripped at the Veteran pit, compared with 4,695,448 in 1955; and no stripping went on at the Kimbley, although 113,276 tons were stripped in 1955.

An extensive exploration program was conducted at the *Mount Wheeler* mine in Nevada last year with negative results. A further exploration is being considered. *American Zinc Lead and Smelting Company* owns 22.15 percent interest in the mine.

Union Carbide Nuclear Company has closed its *Riley* tungsten mine 15 miles northwest of Golconda, Nevada. The shutdown reportedly was caused by Congressional failure to allocate funds for continuing the stockpile program.

The *Van Ness* mercury mine in the Barcelona district of Nye County, Nevada has been leased to A. D. Drumm Jr. of Fallon. Extensive development work should begin shortly under the direction of Keith N. Meadro, consulting geologist of Reno. The property is owned by John Connolly and Mrs. Homer Williams.

Seven barite claims on Dry Creek, 50 miles north of Wells, Nevada have been sold to the *American Colloid Company* of Chicago by Mr. and Mrs. Herb Butler and Mr. and Mrs. Martin Saunders. Three additional claims reportedly are being held by the partners until the outcome of further exploration work. The firm originally optioned the claims, known as the *Jungo* claims, in July 1956. An access road was built, and core and diamond drilling conducted. The firm paid $35,000 for the property.

NEW MEXICO

Homestake-New Mexico Partners expects to have its shaft bottomed this month. The firm's property is in Sec. 32, T. 14 N., R. 9W. in Ambrosia Lake, New Mexico. A ventilation hole has been completed with 32-inch casing to 610 feet, and 12-inch from 610 to 640 feet. This hole will be used as ventilation and a emergency shaft. Buildings and equipment have been installed. Construction of the 750-ton mill is ahead of construction plans, and *Western-Knapp* hopes for completion by December.

According to reports from *Kerr-McGee Oil Industries, Inc.*, which owns 25 percent interest in *Farm Chemical Resources Development Corporation*, a $8,000,000 to $10,000,000 mill may be erected on the potash property near Carlsbad, New Mexico after mining operations have been established. Kerr-McGee reports it has invested about $500,000 in the project to date. Other partners are *Phillips Chemical Company* and *National Farmers Union*.

Calumet & Hecla, Inc. is sinking a shaft on its uranium property under lease in Sec. 23, T. 13N., R. 9W., Ambrosia Lake area of New Mexico. Ore reserves are conservatively estimated at 500,000 tons. Diamond drilling is continuing.

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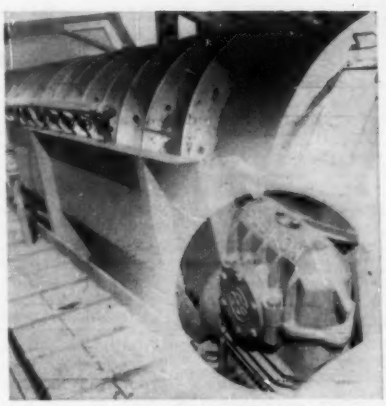

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Copper Purchase Contracts in Effect April 1, 1957 Under Provisions of Defense Production Act of 1950

Name of Company	Type of Contract	Short Tons	Floor price — cent per pound	Year Contract Ends
Rhodesian Congo Border Power Company	Firm contract-market price time of delivery	18,000	—	1962
Falconbridge Mines, Ltd.	Contractor's option-fixed price	12,500	19	1961
International Nickel Company	Firm contract-fixed price	50,000	27*	1959
Banner Mining Company	Firm contract-fixed price	6,480	31	1957
Calumet & Hecla, Inc.	Contractor's option-fixed price or government option-market price	53,000	25.25*	1962
San Manuel Copper Corporation	Contractor's option-fixed price or government option-market price	347,500	24*	1962
White Pine Copper Company	Contractor's option-fixed price	243,750	25.5*	1961

*Current floor prices are higher due to escalation to reflect higher costs of production.

Lisbon Uranium Corporation and *Mineral Resources Ltd.* will finance a proposed $500,000 drilling program covering 15,000 acres in 22 sections of Townships 13-14 North and Ranges 8-9 West, Valencia County, New Mexico. The claims are owned by *Yucca Mining and Petroleum Corporation* which will retain a 10 percent royalty interest in them. The work will be done by the *E. J. Longyear Company* which plans to drill 100,000 feet of hole in search of uranium on the San Mateo dome. This is near the famous Ambrosia Lake district of New Mexico.

Shambeck Brothers of Lubbock, Texas are developing a group of mining properties in the Burro and Langford Mountains of southwestern New Mexico, owned by John C. Bailey and Ernest L. Aguayo of Lordsburg. Plans call for development of gold, silver, copper, and radio-active minerals, and also for possible construction of a mill.

International Minerals & Chemical Corporation has a new design for ore loading stations on the sylvite level in the potash mines at Carlsbad, New Mexico. This has simplified transfer of ore into mine cars by eliminating the old transfer elevators in the dumping of the shuttle cars, and provides for dumping of two shuttle cars at one time. The new loading station is only one element in a loading system which includes a loop track which enables gathering motormen to spot empty cars at one end of the string and run around and pick up loaded cars from the other end.

St. Anthony Uranium Corporation, a wholly owned subsidiary of *Climax Molybdenum Corporation*, has started making shipments of uranium ore from its property 1½ miles north of the *Anaconda Company's Jackpile* mine in New Mexico. St. Anthony's property is in Sections 29 and 30, T. 11 N., R. 43 E. Valencia County, on the *Cebolleta* land grant. There is an estimated 200,000-ton ore body to be mined from a 300-foot shaft, which has been completed.

The famous old *Alhambra* mine in the Black Hawk district of Grant County, New Mexico is being reopened under a lease arrangement between the owners, *Leach & Leach*, and James McGregor of Dallas, Texas. New equipment has been installed and the mine is being unwatered. It has been idle since 1893. The ore carries a variety of minerals. Very massive silver was mined which reportedly was so metallic that it was cut from in place with chisels and hoisted in irregular masses with chains to the surface. The nickel and cobalt arsenides also contain small inclusions of bismuthinite and tin in the form of stannite. Gold values are usually low. Pitchblende occures in veinlets and masses with small amount of rhodochrosite and dense red chert. Originally, only the silver was recovered; however, Mr. McGregor is a chemical engineer and he plans to segregate the several different metals electrolytically.

Seaboard Oil & Gas Company of Wichita Falls, Texas has completed purchase of the *Jeter* uranium mine in Ladron Mountain, about 18 miles southwest of Belen, New Mexico. The first one-half interest had been bought some time ago for $100,000. The remaining interest was purchased for more than $100,000. The *UTCO Uranium Corporation* with offices in Belen, has a long-term lease on the property with an option to purchase a half interest. About $70,000 worth of uranium was produced in 1956, and the company has a contract with the AEC to supply 1,000 tons a month. They plan to increase production to 1,500 tons monthly, with an eventual increase to 2,500 tons. The holdings cover 440 acres. Production is currently coming from the *Charlie No. 2* mine.

Lessees have been operating the property of *United States Smelting Refining and Mining Company* at Bayard, New Mexico. Two lessees have been producing zinc-lead ores, and one lessee has produced copper and copper-zinc ores. The mill, operated by the company, treated the ores produced. Toward the end of last year, unwatering of the Princess shaft was started preparatory to extending leasing activities into that part of the property.

Exploration and development mining has started at *Mercury Uranium & Oil Company's San Pedro* copper mine 35 miles northeast of Albuquerque in Santa Fe County's San Pedro Mountains. Tracks are being laid in the Swan Tunnel for main passage into the mine from the south and to haul ore mined. The Carnahan shaft is being renovated. Ore will be stockpiled for concentrating in a new mill which the company plans to construct later in the year.

Lessees operating in the *Linchburg* mine of the *New Jersey Zinc Company* at Magdalena, New Mexico discovered new reserves. Development work is being undertaken which may be completed this year.

The United States Atomic Energy Commission has discontinued the practice of paying for the vanadium content of non-carnotite ores at the Grants, New Mexico, government-operated buying station. No change will be made in the schedule for carnotite-type ores, and the producers will continue to receive payments for the vanadium content as provided in Circular 5, Revised.

Drilling to date at the *Ike No. 1* mine recently acquired by *Rio de Oro Uranium Mines Inc.* under lease from *Parador Mining Company* has been extremely favorable. Enough ore has been blocked out to justify a shaft on the property and shaft sinking is now underway. The ore body may prove to be of greater importance than the *Dysart Mine No. 1*. Rio acquired 39 unpatended lode mining claims on the lease arrangement with Parador. In return the company has agreed to pay a 10 percent royalty on all uranium ores produced, plus $1 per ton on the first 300,000 tons of ore mined and raised to the surface.

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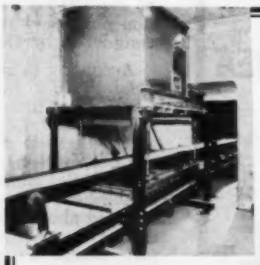

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African Mineral Survey Completed by Longyear

The E. J. Longyear Company has completed its contract with the Portuguese government for the reconnaissance mineral survey of 140,000 square kilometers in Angola and Mozambique, Africa. The areas covered included three provinces in Angola and two in Mozambique.

The reports are in five volumes and the maps accompanying these reports comprise in total an area of almost 2½ acres of cartography. Both reports and maps are on file with the United States Geological Survey in Washington, D. C.

Reynolds, Jamaica Agree On Bauxite Development

Reynolds Metals Company and its wholly-owned subsidiary, Reynolds Jamaica Mines, Ltd. have signed a contract with the Government of Jamaica establishing bauxite royalties and taxes for 25 years and guaranteeing the right to mine the ore for 99 years. Reynolds Jamaica Mines, Ltd. has acquired approximately 60,000 acres of bauxite properties since 1944. The contract guarantees that Reynolds will be granted mining leases on such lands at any time when it makes application during the next 50 years. The leases will be for an initial term of 25 years renewable by the company for an additional 25 years. The Government agreed not to grant mining leases to others on such lands for 99 years.

Under the agreement, Reynolds will pay a royalty to the Government of Jamaica, as owner of the minerals, of three shillings a long dry ton on the first 2,000,000 tons shipped each year and two shillings on the excess above 2,000,000 tons (a shilling equals 14¢). The company plans to ship at a rate of more than 2,000,000 tons this year.

Half of the royalty will be fixed for 25 years. The other half will escalate up and down in direct ratio to the price of aluminum pig in the United States. This enables the parties to establish royalties for 25 years as contrasted with the short five-year term under which the company has been mining the ore in Jamaica since 1952.

Among other terms of the contract, Jamaica also agrees to impose no export duty for 25 years, and agrees that until March 31, 1982, no further taxes or burdens of any kind will be imposed on bauxite operations. This includes taxes on severance, transportation, storage, handling, employment, sales, shipping, or capital.

AEC Buying Lithium-Six Isotope—Use Undisclosed

The United States Atomic Energy Commission is now and has for some time been purchasing "virgin" lithium hydroxide from three major domestic lithium mining and chemical firms. These firms are believed to be Foote Mineral Company (five-year contract publicly announced), The Lithium Corporation of America, and the American Potash and Chemical Company.

The AEC has not announced the end use of the material but it is believed to be for the hydrogen bomb, according to industry sources. It is known, however, that the AEC is primarily interested in the lithium-six isotope which is one of the two natural isotopes.

Under existing contracts the lithium suppliers have the right to purchase the lithium hydroxide (minus the isotope) from the AEC. This material is chemically the same as the original product and can be used for a wide variety of commercial products.

Stockholm's International Mineral Dressing Congress To Hear Speakers From 11 Nations

Representatives from 11 countries will present papers at the International Mineral Dressing Congress to be held in Stockholm, Sweden, September 19 through 21. The official languages during the technical sessions will be English, French, and German. Simultaneous translation will make it possible to follow the proceedings in any of these languages.

The United States will have six representatives: H. W. Hitzrot, manager, eastern industrial division of Dorr-Oliver, Inc., whose paper is titled "The Newer Classification Tools—Their Evolution and Recent Applications"; Thomas E. Ban, director of research for McDowell Company, Inc., "Sintering of Fine Grained Hematite"; Frank W. McQuiston, chief metallurgist at Newmont Mining Company, "Flotation of Complex Copper-Lead-Zinc Ores"; Bruce Clemmer, U. S. Bureau of Mines, Salt Lake City, Utah, "Application of Solvent Extraction in Processing Uranium Ores"; J. P. Grothe and B. H. McLeod, both of Dorr-Oliver's engineering department, "The Influence of Fluidized Roasting on Hydrometallurgical Processes."

H. W. HITZROT

T. E. BAN

The host country, Sweden, will be represented by eight authorities: P. G. Kihlstedt, professor of minerals beneficiation at the Royal Institute of Technology, will present the paper "Flotation of Hematite With Tall Oil Emulsions"; Gotthard E. Björling, also from the Royal Institute, "Reducing Leaching of Ores"; Jonas Svensson and Jakob Murkes, "An Empirical Relationship Between Work Input and Particle Size Distribution Before and After Grinding"; S. Eketorp, "Magnetic Roasting of Hematite"; C. Du Rietz, "Theoretical Investigations on Fatty Acid Flotation"; E. Svenke, "Leaching of Uranium Ores"; A. Danielsson, "A New Spectrometric Technique for Analyzing Fine Ground Material".

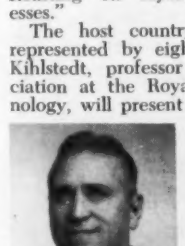
G. E. BJORLING

R. T. HUKKI

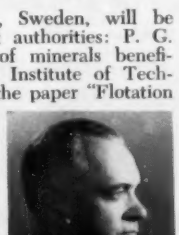
Finland will have five men on the program: R. T. Hukki, professor of mineral dressing, The State Institute for Technical Research, will speak on "Grinding at Supercritical Speeds in Rod and Ball Mills". According to Mr. Hukki, "Grinding at supercritical speeds is comparable to flying at supersonic speeds. Unbelievable speeds can be effectively used. With pilot plant equipment, the speed range up to 300 percent of the theoretical critical has been tested, and with a laboratory mill up to 2,000 percent. The process has been covered by a number of patents pending."

Heikki Tanner, mine superintendent at the Kerriti mine, Outokumpu Oy, together with Timo Heikkinen, mill superintendent at Outokumpu, will present the paper "Crushing and Grinding at Outokumpu"; Urmas Runolinna, mill superintendent at Otanmaki Oy. "Dry Magnetic Separation of Finely Ground Magnetite" (Mr. Runolinna's article "How Otanmaki Floats Ilmenite From Finland's Titaniferous-Magnetite" was published in the April 1957 issue of MINING WORLD); P. Kivalo and E. Lehmusvaara, "An Investigation into the Collecting Properties of Some of the Basic Components of Tall Oil".

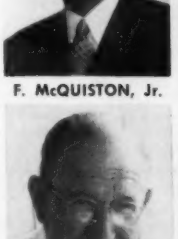
France will send Maurice Rey, professor of non-ferrous metallurgy, So-



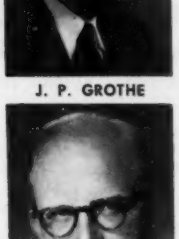
F. McQUISTON, Jr.



J. P. GROTHE



B. H. McLEOD



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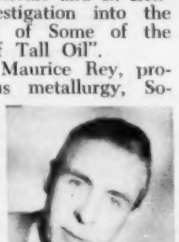
U. RUNOLINNA



M. REY

new in copper country . . .

THIS VULCAN
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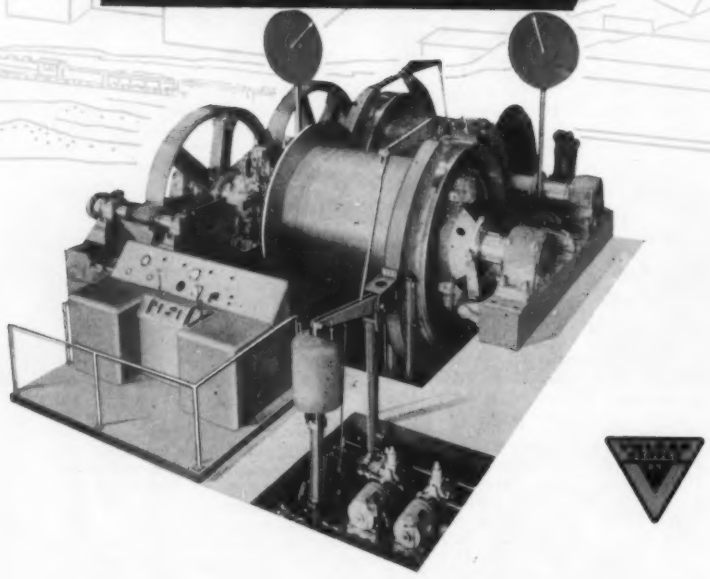

Two of these Vulcan-Denver hoists have just been delivered for a double assignment. First they will be used in sinking a main shaft. Then they will be taken below ground for further use.

Because of the need to go through an opening about four feet square, each hoist breaks down into segments of suitable size. The design is such that this in no way affects the strength or traditional superior performance of Vulcan hoists. The dual drive is capable of putting the combined power of both drive motors into either drum for 30,000 lb. of rope pull. Clutches are radial acting dental type. All principal shaft bearings are anti-friction roller bearing.

These are only two of many Vulcan hoists working in "your kind" of service. Name your specifications...Vulcan can build to your needs from six decades of design experience.

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ciété Minière et Métallurgique de Peñarroya, to speak on "Differential Flotation of Lead-Zinc Ores—a Tentative Classification of the Ores and of Flotation Techniques".

Great Britain will send five ore dressing experts: A. Z. Trangiskos and H. G. Smith, "The Effect of Some Surface Active Reagents on the Comminution of Limestone and Quartz"; D. W. Mitchel and W. Davies, "Developments in Sintering Efficiency"; E. Cohen, "Simple Microscopy for Plant Control in Mineral Dressing".

The U.S.S.R. has named six representatives: S. I. Mitrofanov, "Solution of Some Problems Concerning the Theory and Practices of Selective Flotation in the U.S.S.R."; Mr. Mitrofanov, in conjunction with V. G. Kusnikova, "Adsorption of Diethylditihiophosphate and Butyl Xanthate by Sulphides"; O. S. Bogdanov & al., "Investigation of the Action of Modifying Agents in Flotation"; A. S. Konev and L. S. Debrivnaja, "Separation of Bulk Sulphide Concentrates by Flotation"; M. A. Eigeles, "Selective Flotation of Non-Sulphide Minerals".

Belgium will be represented by M. Stas, who will read his paper "Influence of the Orifices on the Washing Characteristics of the Hydrocyclone".

Germany's representatives are: H. Kirchberg and W. Hentzschell, "New Experiments on the Function of Jigs"; G. Gerth, "Influence of Surface Properties, Grain Shape and Grain Size of the Medium on Adhesion Losses in Sink-Float Separation"; K. Finn, "Beneficiation of Titanium Ore".

Austria is sending H. Hohn to speak on "Investigation on Chlorination of Ores".

Three Italian experts will present papers at the Congress: Guiseppe Bellavita, vice-manager of ore dressing mill, Miniere di Montevecchio, together with R. Antoniolli, will offer "Jigs Concentrates and Flotation Concentrate as Heavy Media at the Huntington-Heberlein Sink-Float Plants of the Monteveccio Company"; E. Occella, "Extension of Washability Curves to the Magnetic Separation of Minerals".

South Africa will be represented by the paper of J. Levin, resident officer at the Government Metallurgical Laboratory, Witwatersrand University, Johannesburg, "Flotation of Uranium from the Gold-Uranium Ores of the Witwatersrand and the Orange Free State".

Following the regularly scheduled sessions of the Congress, a tour will be conducted to several of the outstanding metallurgical installations in the area. The meetings and tour are open to all interested metallurgists, and further information may be obtained by writing the International Mineral Dressing Congress, Nackstromsgatan 1, III, Stockholm, Sweden.

Empire Star Absorbed By Newmont in Merger

Through a mutual agreement, Empire Star Mines Company, Ltd. will merge into Newmont Mining Corporation at the rate of one share of Newmont stock for four shares of Empire Star. Newmont has been the principal stockholder in Empire Star for several years, with 37.3 percent of its outstanding shares. Empire Star has been one of the largest United States gold mines.

Empire Star owns the Empire and North Star gold mines at Grass Valley, California, where operations were suspended in July 1956 as the result of a labor strike, and remained closed because operation was proving unprofitable even at existing wages. Reserves of gold-bearing rock are large and prospects good for additional development under the right economic conditions.

Production for 1956 up to the closure was 20,850 tons of ore valued at $755,397, an average of $36.22 per ton. In 1955, 33,942 tons brought $1,616,325, an average of $45.06 per ton.

Empire Star also owns mining and timberlands in California and has engaged in some exploration work.

Mitsubishi Firms Launch Joint Venture In Chile

The Mitsubishi Mining Company and Mitsubishi Shoji Kaisha are planning to develop iron mines in Chile with a Chilean partner who owns three mines in the vicinity of Copiapo City.

One of the mines is said to have reserves of 25,000,000 tons of iron ore with a grade of 66.1 to 68.52 percent iron. Ore reserves are estimated at 7,000,000 tons.

The first part of the joint venture, from May 1957 to April 1958, calls for the Japanese partners to send 10 Japanese mining engineers to the mines and to make a cash investment of $500,000 for mine exploration and surveying. The second part of the plan, extending from May 1958 through 1960, provides for the establishment of Japan-Chile Iron Joint Venture, and the commencement of shipping during 1960 of 1,000,000 tons of iron to Japan annually. Shipments will be made through Caldera port on the Pacific, 55 kilometers west of the Copiapo mining district.

New Park and Associates Will Mine in Guatemala

New Park Mining Company of Salt Lake City will take part in a joint venture with San Luis Mining Company of San Francisco, and a Boston syndicate to mine lead carbonate ores in Guatemala. The three concerns will have equal interests in the newly formed Campania Minera Maya, S.A., with options on three promising properties in the municipality (county) of Huehuetenango in northwest Guatemala, about 7½ miles south of the Mexican border.

This is New Park's first participation outside domestic western mining operations. San Luis is the mining branch of the William Randolph Hearst estate and a stockholder in Homestake Mining Company. Homestake, however, has no part in the new venture.

The members of the Boston syndicate have not been disclosed, but the operating committee of Campania Minera Maya will be made up of J. W. Swent, president of San Luis and vice president of Homestake; Robert L. Cranmer, New Park secretary and counsel; and Robert Strange, representing the Boston syndicate.

Work at the properties has so far consisted of drifting and cross cutting. The deposits appear to lie in "pipes" (circular type deposits outcropping on the surface), or "books" (rectangular outcrops). The area is near the Pan-American Highway, so the ore can either be shipped directly by truck to smelter, or beneficiated and then smelted in Mexican plants.

Mr. Cramer and associates originally journeyed to Guatemala in search of oil leases for the affiliated Oil Inc., of Salt Lake City.

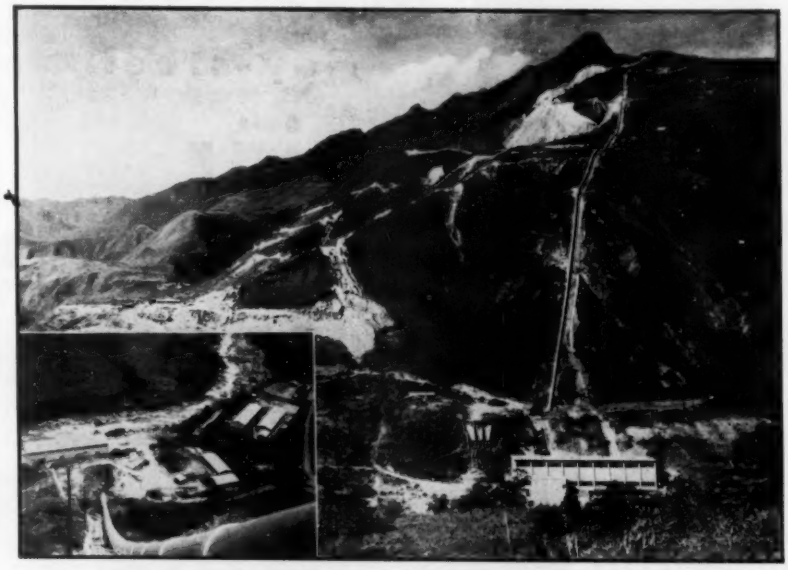
EIRE—*Can-Erin Mines Limited* has set up a complete mining plant at the Mountain mine in Allihies, west County Cork, where 300,000 tons of 10 percent copper ore were produced 75 years ago. Favorable ore indications picked up in the surface drilling program have stimulated development work, and underground mining equipment is now being installed. Work on two additional levels has been started which will trace the downward extension of the ore. The company has established an assay office on the property to speed results. Can-Erin's subsidiary, *Emerald Isle Mining Company, Ltd.*, is developing a copper mine in the same area.

SPAIN—*Sociedad Anonima para la Fabricacion de Aluminio (S.A.D.A.)* was recently organized and will construct an aluminum plant in the Free Trade Area in Galicia, northwest Spain, to produce electrolytic aluminum and aluminum alloys. It will have additional facilities to process such products as wire, cable, plate, pipe, and structurals. The reduction plant will have an annual capacity of 20,000 tons of virgin aluminum and alloys, and will operate mainly for the export market.

U.S.S.R.—A large steel plant is under construction to develop the 50,000,000,000 tons of low-grade iron ore in the Krivoi Rog basin of the Ukraine. The higher grade ore is virtually exhausted. During 1956 the Soviet Union produced 78,000,000 tons of iron ore, with the Ukraine contributing 43,700,000 tons, or 56 percent, and practically all of this is from Krivoi Rog. No large steel plants are in operation at the basin, because it has been found more economical to ship the high-grade ore to other steel mills in the Ukraine and elsewhere in Russia. However, shipment of the low-grade ore would be impractical. The *Magnitogorsk* steel plant in the Urals, largest in Russia, is seeking a speedy conversion to facilities to handle lower grade ore.

CORNWALL—*The Hydraulic Tin Company* has resumed operations on accumulations of tin-bearing residues which have been piling up for several years in the Bissoe Valley, near Truro.

U.S.S.R.—A huge iron and steel plant is under construction in Alma Ata to process ore from the *Atasusk* iron fields.



Cerro de Pasco Opens New Hydroelectric Plant

Cerro de Pasco Corporation's $25,000,000 hydroelectric power project which has been under construction in Peru for five years has been successfully completed. Power is now being generated in the new plant and transmitted some 89 miles to Oroya, the location of Cerro de Pasco's lead-zinc smelting and refining operations. Water of the turbulent Paucartambo River, which has its source in lakes high in the Andes, has been dammed at a site known as Yuncan. From this headworks, the water is diverted into an eight-mile tunnel driven through the mountain and is discharged down a 3,800-foot steel penstock to the power station at Yaupi Bajo. The penstock, power station, and substation can be seen in the photo above. At dedication ceremonies of the 72,000-kva hydroelectric plant, the company confirmed that it is studying the possibilities of establishing an alumina reduction works in conjunction with another projected hydroelectric development. The combined plan is for a power plant with an ultimate potential of 750,000 kilowatts at Mantaro Bend, coupled with an aluminum works near the Bay of Paracas. Estimated capital cost would be about $200,000,000 for the hydroelectric development. Alumina would be imported.

When completed the plant will cover 100 square kilometers and employ 7,500 workers.

ITALY—A recent government ruling permits the importation of gold for industrial use. Applications for licenses are filed through the *Federation of Goldsmiths* and the gold imported is allocated by ingots weighing 12.44 kilos each, non fractionable. Payment by the importer is made to the Italian Exchange Office in bank notes at the rate of $14,000 United States dollars per ingot.

EIRE—*New Spring Coulee Mining Corporation* of Toronto is surveying mineral deposits in various sections of County Donegal and in Connemara. Some molybdenite has been found at Murvey, Connemara.

NORWAY—*Norsk Bergverk A/S* plans an extensive campaign to find customers from abroad for the columbium concentrate from its *Sove* mine, which has reserves of about 6,000,000 tons of columbium-rich limestone. A new refining plant is now in operation at Sove to reduce the phosphorus content of the concentrate to less than 0.1 parts per million and the sulphur to under 0.5 parts per million. Recently, the Sove mines changed from open-pit to underground mining. Automatic ore conveyor belts run from a 450-foot-deep vertical shaft directly to the ore dressing plant.

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BUT NOBODY
BUT . . .
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weldless
alloy-steel
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drills up to 4 times more footage-with fewer fishing jobs
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For over 60 years Manufacturers of Spang Weldless Jars and a Complete Line of Cable System Drilling and Fishing Tools for Oil and Gas Wells, Prospect Drilling and Shot Blast Holes.

JAPAN—*Oppu Mining Company Ltd.*, a subsidiary of *Mitsubishi Metal Mining Company*, plans to expand capacity of its mill at Aomori-Ken to 10,000 tons monthly by March 1958. Mine output during the period from October 1956 to March 1957 was 6,500 tons which was 2,000 tons over the previous six-month period; current output is rapidly approaching 7,500 tons. When the mill reaches the 7,500-ton stage, it will be producing 280 tons of 22 percent copper, 480 tons of 58 percent zinc, 194 tons of 77 percent lead, and 825 tons of pyrite concentrate monthly.

TURKEY—It has been reported that an iron ore deposit with a proven reserve of 1,000,000 tons of 55 percent Fe has been located near Milas in southern Turkey. A private company is said to be developing it.

JAPAN—*Toyoha Mining Company Ltd.*, a subsidiary of *Nihon Mining Company*, expects its monthly output at its *Toyoha* mine in Hokkaido to reach 10,000 tons shortly. The company will be producing 1,000 tons of 54 percent zinc, 450 tons of 61 percent lead, and 2,000 tons of 46 percent pyrite concentrates monthly.

MALAYA—A group of Malay businessmen are said to be sponsoring the organization of a tin mining syndicate in Province Wellesley, and permission to mine is being sought from the Settlement Government. The mining area would be in Central Province which is believed to contain rich tin deposits. A European organization has already applied for prospecting rights in the same area.

TURKEY—The new *Turk Molibden Sirketi* organized recently (see MINING WORLD, February 1957, page 108) will soon install a 300-ton-per-day flotation plant. The firm will develop a molybdenum mine 70 kilometers south of Bursa, where reserves are estimated to contain about 500,000 tons of 0.4 percent Mo.

JAPAN—The *Nippon Soda Company* reportedly will ship 600 tons of titanium sponge to the *Mallory Sharon Company* in Ohio over a 12-month period. Under a previous contract, the company had been supplying the United States firm with about 13 tons monthly. The Japanese company will now increase its capacity until it reaches 70 tons monthly.

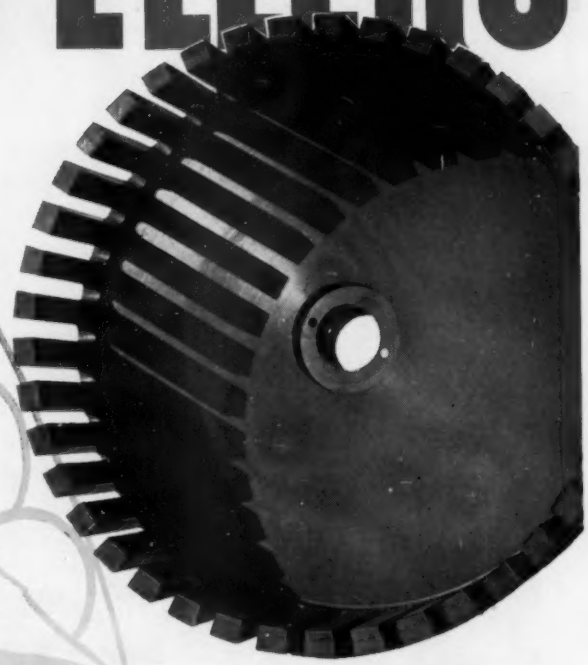
INDIA—The Indian Atomic Energy Department has revealed the discovery of a large deposit in northeast India containing thorium, uranium, and ilmenite.

TURKEY—*Newmont Mining Corporation* plans to conduct diamond drilling in the ancient Balya District of Turkey during 1957. The firm plans to test the possible existence of undisclosed lead-zinc ore bodies similar to those previously mined in the district during the half century prior to 1939. At that time the district had yielded about 4,000,000 tons of high-grade ore.

MALAYA—*Petaling Tin Ltd.* will continue its efforts this year in diverting the Klang River in the Puchong Area. Latest estimates indicate that construction and consolidation of the new river channel

As like as peas in a pod!

Pressure-Molded (RUBBER COVERED) IMPELLERS



Pressure molding of the rubber covering of the metal core of the AGITAIR® impeller results not only in an amazing uniformity and perfect bond but also speeds up production to meet the rising world demand for this rugged flotation machine.

Another unique feature of the AGITAIR® is that aeration is not dependent on impeller speed because of the utilization of a constant external air supply. This allows lower impeller speeds with resultant longer life of operating parts without jeopardizing metallurgical efficiency.

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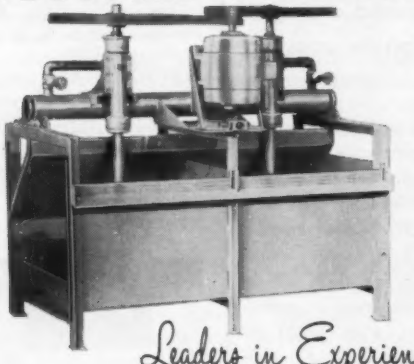

The marked improvement in the impeller-heart of AGITAIR®— results in a greater uniformity of operation.

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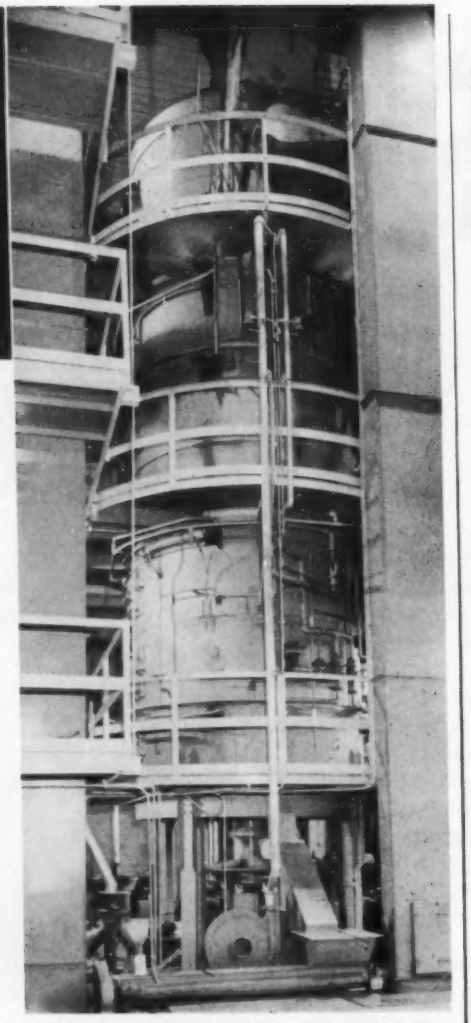

The S. W. Shattuck Chemical Company's new, modern plant in Denver, includes an 8' I.D., 8 hearth gas-fired Skinner Roaster for roasting molybdenum concentrates.

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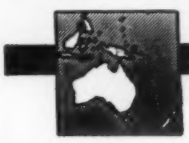
over a length of 1¾ miles will be completed in approximately two years. In the meantime, the No. 6 dredge will operate first in tailings and subsequently in virgin ground carrying good values. Its course will be arranged so that it can enter the northern end of the present river course as soon as the river diversion is completed. A higher rate of production can then be anticipated for several years.

GOA—The *Sirigao* iron ore mines of *Chowgule & Company*, the only mechanized mines in Portuguese India, have reverted to manual operation because of the recent bombing of the power installations and crushing plant by terrorists. Damage was estimated at 1,500,000 to 2,000,000 rupees. The main power house equipment, said to be the largest in the country, consisted of two 750-horsepower Hitachi Diesels with 500-kva generators; the auxiliary power was supplied by two 15-kva generators. The crushing plant housed an 80-centimeter gyratory crusher driven by a 300-horsepower electric motor, and could crush 400 tons per hour. Output from the mines for export had been about 2,000 tons of iron ore daily. Since most of the equipment was electrically operated, work now will depend largely on availability of manual labor until the plant is rebuilt.

JORDAN—The Jordanian government which owns a controlling interest in the *Jordan Phosphate Company* has given permission to export 450,000 tons of phosphate during 1957. It is understood that these shipments will be made mostly to the Far East, but also to Yugoslavia and Italy. Some of the production comes from open-pit operations, but a larger proportion is from shallow underground workings. Little or no processing is required before shipment.

KOREA—According to the statistics compiled by the Mining Bureau of the Commerce and Industry Ministry, the number of mining claims registered and licensed to go into operation totals 5,582 mines. Those actually set to operate during 1956 amounted to only about 20 percent, however, or 1,138 mines. The statistics indicated that gold and silver mining tops all fields with 1,287 claims registered, while regionally Kangwon Do Province had the largest number of claims registered—1,260.

TURKEY—A copper deposit near Sariyer on the European side of the Bosporus Strait is being examined for the first time. The deposit has been known for many years but has never been thoroughly investigated. It is held by the Turkish government.



OCEANIA

NORTHWEST TERRITORY—*Mount Isa Mines Ltd.* has discovered an "encouraging" outcrop of oxidized lead at the McArthur River homestead. Prospecting work may take more than two years. An outcrop has been delineated by surface trenching. Dimensions are about 400 feet by 120 feet and lead content is about 10 percent. A shaft to 60 feet and a crosscut of 70 feet from it also disclosed 10 percent lead ore. Further shafts are being sunk from which crosscuts will be driven at the 60-foot level. Attempts

Dowa Mining's Kosaka hydro-metallurgical plant where Dorrco FluoSolids System roasts 83 metric tons of complex copper-zinc concentrates per day.

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Processing copper bearing pyrrhotite ore, the Dowa Mining Company at the Okayama, Japan plant is producing . . . and all from the same raw material . . . sintered iron ore for blast furnace use, cement copper and sulphuric acid.

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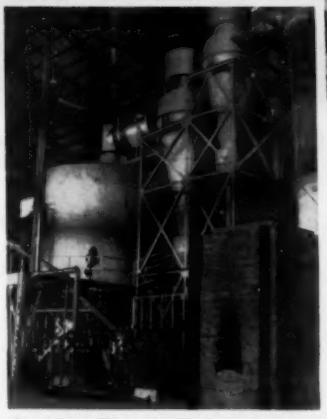
The Dorr-Oliver research, design and engineering staffs and our Associates in Japan, Sanki Engineering Co. Ltd., of Tokyo, have collaborated with Dowa Engineers before. At Dowa's hydro-metallurgical plant in Kosaka, Japan, Dorrco FluoSolids System is a prime factor in the world's first successful roasting of copper and zinc with electro winning of both metals. In the Okayama installation as at Kosaka, manufacture of the FluoSolids Reactors and a number of components in Japan with auxiliary equipment furnished from the U. S. proved to be most advantageous to Dowa.



One of two 20 ft. dia. FluoSolids Reactors roasting 235 metric tons per day of crushed pyrrhotite ore at Dowa's Okayama Plant.

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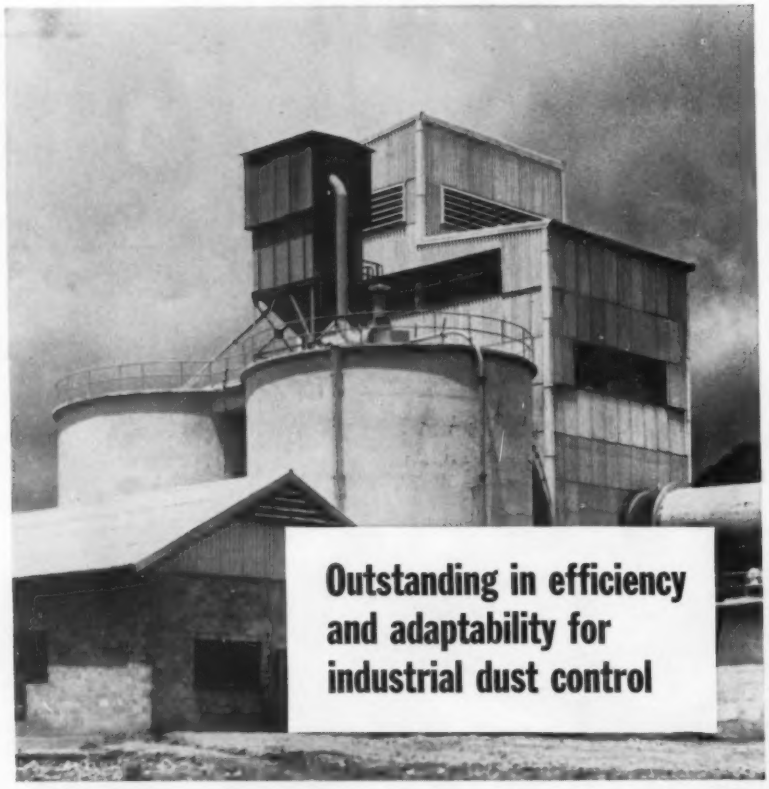

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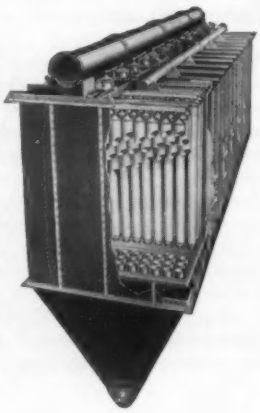

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to drill the ore body last year were inconclusive because of very poor core recovery. Diamond drilling in depth will start shortly. McArthur River Station is about 400 miles from Mt. Isa, in the northeast corner of the Northern Territory. The outcrop is 33 miles southwest of Boorooloola and seven miles northwest of McArthur River Station.

REPUBLIC OF THE PHILIPPINES—*Baguio Gold Mining Company's* board of directors have approved a merger with the *Gold River Mining Company* which will be accomplished through an exchange of stock (one share of Baguio for six of Gold River). This is expected to double the company's Baguio property, simplify operations, and increase efficiency.

SOUTH AUSTRALIA—A deep shaft reportedly is being sunk at Crockers Well to obtain more information about uranium ore at depth. This may soon become a major venture.

REPUBLIC OF THE PHILIPPINES—*Liberty Chromite Mining Corporation* expects its first shipment of metallurgical grade chromite to be made shortly, less than one year since the company started operation. Road and pier construction are progressing satisfactorily, and 500 tons of chromite have been stockpiled. The company's property is in Palawan, and some additional properties have been acquired in Giporles, Samar.

NEW ZEALAND—The west coast dredges at Arahura and Kaniere are obtaining good production figures. Arahura dredge is treating 200,000 to 220,000 cubic yards per month for a recovery of 1,000 to 1,500 ounces of gold bullion. Kaniere dredge is handling up to 320,000 cubic yards per month for 900 to 1,100 ounces of bullion.

REPUBLIC OF THE PHILIPPINES—*Gabun Paracale Mining Company* reports discovery of two iron ore bodies and presence of at least 50,000 tons of float ore on two of its lode mining claims in the Paracale region. The discoveries were made on the *Lucky 19* and *Lucky 20*, two of the 67 mining claims of the company. The ore is said to be a true oxide not associated with sulphide ores. The company is launching large-scale production shortly.

QUEENSLAND—*Tableland Tin N.L.* at Mount Garnet has been going through a period of low production (15 to 20 tons of concentrates per month instead of 50 to 60 tons) because it encountered a band of hard, cemented wash. Yardage has been 120,000 to 130,000 cubic yards per month instead of the normal 200,000.

NEW SOUTH WALES—*Crescent Rutile N.L.* is installing power in its treatment plant at Kilcare, between Sydney and Newcastle, and production of heavy mineral is expected to start there shortly. Separation of the rutile may start in July. Crescent Rutile has taken an interest in *Cable (1956) Ltd.*, an ilmenite producer at Bunbury, Western Australia. Meanwhile, it is doubtful whether some of the other new rutile companies will ever begin operations. Buyers who have been holding off because of possible market flooding by all of these potential producers may be disappointed. Low-grade rutile areas containing a large magnetic fraction on the far South Coast may prove of interest if current tests with recently developed wet magnetic separators prove efficient.

INDONESIA—In anticipation of the new mining law, the government has

ordered that the status of every working mining operation in Indonesia be changed to N.V. (Naamloze Vennootschap) which follows the Indonesian laws and has its registered office in Indonesia. An N.V. which is not working its concessions will be obliged to bring in its investment plan within a year and to start working the claims or they will be cancelled. In regions that are inaccessible at present, a moratorium will be granted.

QUEENSLAND—*Uranium Holdings N.L.* has completed negotiations with *Australian Mining and Smelting Company Ltd.* and *Titanium and Zirconium Industries Pty. Ltd.* (subsidiary of *Consolidated Zinc Pty. Ltd.*) for the purchase of leases totalling 302 acres near Tweantin. The areas have been drilled by Consolidated Zinc and contain 20,174 tons of recoverable rutile and 22.73 tons of recoverable zircon (based on 80 percent recoveries). Payment is approximately £101,000 (about £5 per ton of rutile).

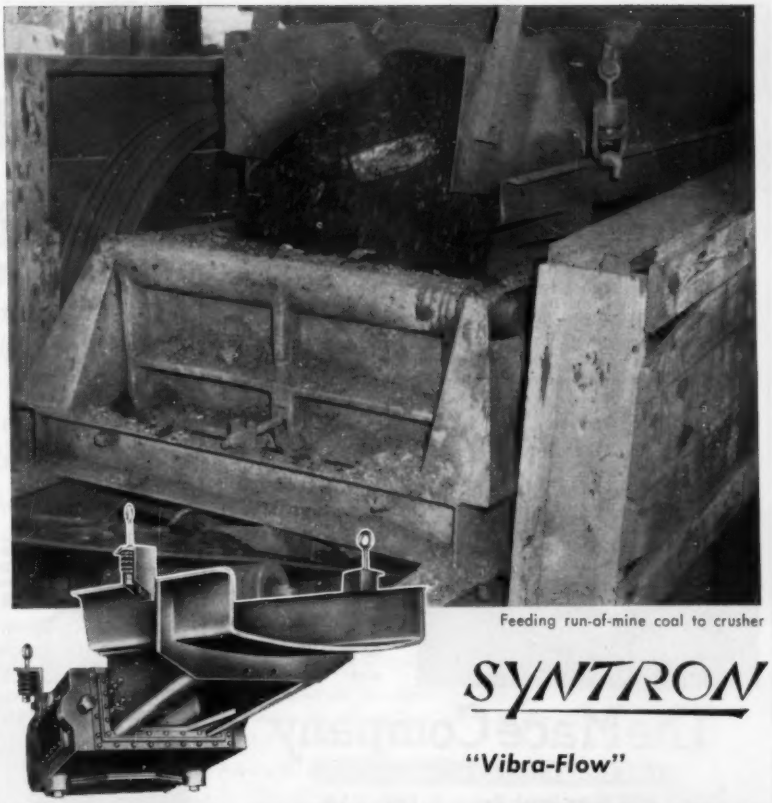
REPUBLIC OF THE PHILIPPINES—*Itogon-Suyoc Mines* has increased capacity of its Itogon mill to 650 tons per day. Development work is continuing in the *Itogon* mine with encouraging results on the 500, 350, and 300 levels. Ore of above average grade is reportedly being developed on the 300 level 31 Vein. The new 23 crosscut from the 23 shaft to the Taka shaft cut the 14 Vein which showed high-grade values at the intersection. Production in the Itogon district for the fiscal year ended September 30, 1956 was 136,730 tons of ore milled for a yield of 21,709,869 ounces gold.

CHILE—*Cerro de Pasco Corporation* has extended its option on the *Rio Blanco* property 32 miles northeast of Santiago where exploration work has been satisfactory. The option originally expired on October 1, 1957, but has now been extended to October 1958. A program of core drilling was started early in 1956, suspended during the winter season, and reactivated in November. Three core drills are now in operation. Cerro de Pasco holds the option under an agreement with *Rio Blanco Copper Corporation* of Virginia which, in turn, holds all of the stock of *Compania Minera Rio Blanco Ltd.*

MEXICO—*Compania Mineral El Tisur*, the Mexican subsidiary of *Republic Steel Company*, reportedly plans to build a titanium ore processing plant at Pluma Hildago, state of Oaxaca, on the Gulf of Tehuantepec. Republic Steel holds large titanium ore reserves in this area. Construction of a port is one of the conditions necessary for development of the property, and soundings are to be made of the harbor to determine its suitability.

HONDURAS—*New York & Honduras Rosario Mining Company* is driving an 11,000-foot tunnel into its *El Mochito* mine to develop the property at depth and to serve as a drainage tunnel as well. The cost of this work, and the higher costs for expansion and for power, were held responsible for the decline in 1956 net income.

CHILE—The *El Salvador* copper deposit being developed by *Andes Copper*



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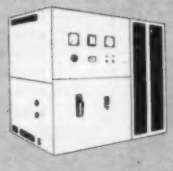

TEST SIEVE SHAKERS

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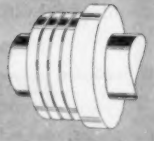

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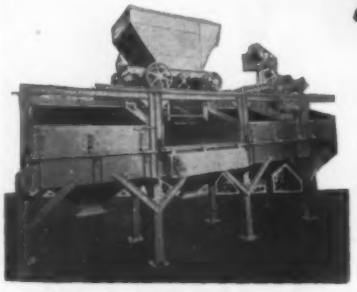

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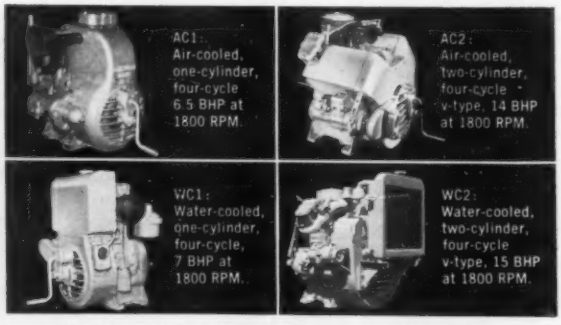

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Mining Company, a subsidiary of the *Anaconda Company*, is proving to be even larger with additional drilling and underground work. First estimates of the reserve had been 78,000,000 tons; this was increased to 200,000,000 tons last spring, and it has now been established that there are at least 300,000,000 tons averaging 1.6 percent copper. This has caused a revision in overall plans from an original investment of $52,950,000 to $80,150,000. A new crushing plant and concentrator with an initial capacity of 25,000 tons of ore per day will be constructed at the mine portal. The Chilean government has issued a decree of approval which establishes a 50 percent income tax rate applicable to the property and waives import duties on machinery and equipment for the project. The cost of developing and equipping the property may be amortized for income taxes over a five-year period after start of operations.

MEXICO—Angel Bejarano is reopening a group of mines which had been closed for a number of years. This is the *Santa Grancisca* mine at Ixtapan del Oro near the Temascaltepec mining district. The property contains silver, gold, lead, and copper.

CHILE—*Chile Exploration Company* (a subsidiary of *Anaconda Company*) is constructing a plant for recovery of molybdenite from copper concentrates. It is expected to go into operation later this year. The firm produced 532,012,067 pounds of copper, 716,908 ounces of silver, and 4,296 ounces of gold in 1956. A system for reclaiming waste water is now in operation. The new Inacaliri water system, supplying Chuquicamata with 10,000 tons daily of additional potable water, is now in service.

PARAGUAY—The government has issued a new mining decree which is designed to encourage foreign capital in the development of Paraguayan mineral resources. Among the concessions granted is exemption from custom duties of imported machinery and equipment to carry out plans approved by the Ministry of Public Works. Also granted is retention and free disposal of 50 percent of the foreign exchange produced.

BRAZIL—A promising nickel deposit is under development in the southern part of the state of Sao Paulo. The *Jeoro* deposit, mainly garnierite, is situated in the Jacupiranga district. Nickel content in the ore is reported to be three to four percent. Five hundred tons were shipped to Japan in February for experiment and it is now reported that a Japanese firm, *Taiyo Bussan Company*, will undertake large-scale development.

CHILE—*Cacremi*, the mining credit bank, has announced that copper concentrates are no longer being received at its agencies in Choapa, Illapel, Combarbala, Punitaqui, Ovalle, and Los Vilos. Purchases are being made only at Coquibo and Paipote. Paipote refinery will increase capacity in order to handle copper stocks from small miners which it is reported that Cacremi will collect instead of shipping them to the United States or Germany. Increased ocean freight rates account for this change.

MEXICO—*Cia. Exploradora del Istmo, S.A.*, a wholly owned subsidiary of *Texas Gulf Sulphur Company*, has placed its Frasch process plant in operation at Nopalapa Dome on the Isthmus of Tehuantepec. Total expenditures of the company in Mexico now exceed $10,000,000, which includes the cost of the plant, and preparation of the deposit for production, as well as a comprehensive program for geophysical and geological exploration which has extended over a period of several years. The subsidiary has concessions in the area of Texistepec, also on the Isthmus, where some exploratory work has been done.

UNION OF SOUTH AFRICA—A two-stage rehabilitation program is planned by the *Merriespruit (Orange Free State) Gold Mining Company Ltd.* at its gold and uranium oxide-bearing property which was flooded by underground water last fall. The first stage involves unwatering and some development work; and the second, limited production and further development to permit resumption of normal production. *Kennecott Copper Corporation*, which has a substantial interest in the property, has agreed to the first stage only. While no new money is required now, after completion of the first phase Kennecott will consider recommendations for further action, including additional financing, in the light of conditions disclosed at that time. Removal of the water from the mine will be achieved by the extension of a main haulage level from the *Virginia Orange Free State Gold Mining Company*, an adjacent mining op-

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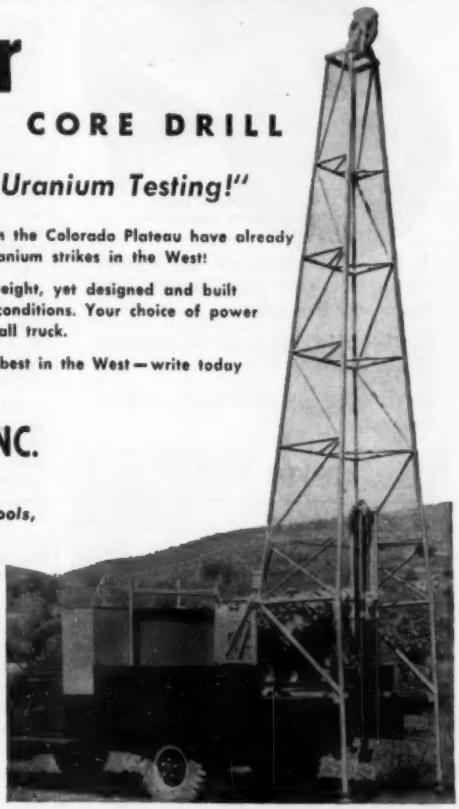

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2B	36"	1280#
2B	42"	1395#
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eration in which Kennecott also has an interest, into the Merriespruit area. Drainage holes will then be drilled into the existing workings and the water drawn off and pumped to the surface by the Virginia pumping system. This procedure should provide a safer and more controlled method than dewatering through the Merriespruit shaft, and should also furnish additional ore development information because the haulageway will be used to explore the Merriespruit area through which it passes.

FEDERATION OF RHODESIA & NYASALAND—The *Kariba Gorge* hydroelectric power project which is being built to supply 500,000 kilowatts to the copper belt in Northern Rhodesia and principal cities in Southern Rhodesia suffered a temporary setback following a partial collapse of a coffer dam well. The latter was caused by abnormally high flooding of the Zambesi River. It is not expected that the incident will interfere with the completion of the project by 1960-1961, however.

UNION OF SOUTH AFRICA—The ventilation component of the *Western Holdings Company's* No. 3 twin shaft system has been completed to its final depth of 3,718 feet in a period of 9½ months. Both components are circular, and the inside lining diameter of the ventilation unit is 18 feet. A feature of the sinking operations was the first use of the Blair-stage hoist, which is also being used in sinking other shafts, particularly in the *Anglo American* group of which Mr. Blair is the consulting mechanical engineer.

GHANA—*Ashanti Goldfields Corporation Ltd.* expects its new Eaton Turner shaft to go into operation this month. The new shaft will make it possible to intensify the exploration and development program which has been underway for some time. A strike 397 feet long was made recently between crosscuts 42 and 50 south on the Cote d'Or Reef. Improvements have been made in the roasting and cyanide methods resulting in a substantial reduction in the amount of gold leaving the plant in cyanide residues. Further improvements are expected as a result of work now being carried out in connection with the gold lost in flotation tailing.

UNION OF SOUTH AFRICA—*Winkelhaak Mines Ltd.* has completed its initial shaft sinking program—two twin-shaft systems—to serve the southern section of the mine. The reduction plant is in early stages of production. Reef development in the No. 3 hoisting component area is expected to be started soon. Water-bearing fissures have been encountered in shaft sinking and development work.

FRENCH GUINEA—Claim jumping is becoming a serious problem in French Guinea. African diggers, many thousands of them, expelled by the Governor of Sierra Leone last December, are reported to have rushed a diamond deposit held by the *Soguinex Company.*

BECHUANALAND—The Geological Survey Department is awaiting results of a gravimetric survey made of the territory last year in collaboration with the Geological Survey of the Union of South Africa. Active interest continues to be displayed in the copper deposits of the *Bushman* mine area northwest of Francistown, and in the nickel occurrence at Magogaphate in the northeastern Bam-

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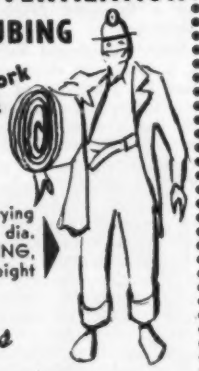

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angwato Reserve. No mining ventures were started in the last year. Chrysotile output was continued by the *Moshaneng* mine in the Bangwakete Reserve in the southern districts. The *Halfway Kop* mine near Francistown in the *Tati Concession* continued kyanite production, while small workings also in the Concession produced small amounts of gold and silver. Output for 1955 and 1956 is compared below; the 1955 figures are in parenthesis. Asbestos 1,355.73 short tons (1,427); gold 589.1 ounces (560); silver 214.7 ounces (189); and kyanite, figures not yet available for 1956 (840 short tons in 1955).

FEDERATION OF RHODESIA & NYASALAND—*Anglo American Corporation of South Africa Ltd.* is investigating uranium-bearing claims in the Umtali district of Southern Rhodesia, over which it recently acquired an option.

TANGANYIKA—Gold output, which suffered through the closure of the *New Saza* mine last year, will be increased when the *Kiabakari* mine in the Musoma district is commissioned by the *Colonial Development Corporation* and *New Consolidated Gold Fields*. The reported mill capacity will be from 15,000 to 20,000 tons a month, and Aerofall mills may be installed.

FEDERATION OF RHODESIA & NYASALAND—*Bancroft Mines* is not building up its production rate as rapidly as originally planned. Production was started early this year at the Northern Rhodesian property, and it was expected that an output rate of 42,800 tons of copper annually would be achieved by the middle of the year. Preliminary work, however, was hindered by strikes by European and African personnel. Another adverse factor was and is the wet nature of the ground being stoped. Most of the ore treated so far has come from the No. 1 shaft area; ore from the No. 2 shaft area was scheduled to be drawn from about the middle of March. By mid-1957 the plant was to be treating 150,000 tons of ore monthly. Drilling continues to determine the southern extension of the Kirila Bomwe South ore body, and the results may cause a revision of the program in the Kirila Bomwe North ore body, where sinking the No. 3 shaft has been suspended for the period until the drilling results mentioned have been obtained. The most recent estimates of the ore reserves, increased as the results of further drilling, are 103,100,000 tons averaging 3.89 percent copper. This tonnage may be increased further as the results of current drilling become known.

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NORTH AMERICA

NORTHWEST TERRITORIES—*North Rankin Nickel Mines Ltd.* has placed its 250-ton-per-day concentrator in operation at its property on the west coast of Hudson Bay. Estimated production this year is expected to be between 6,000 and 10,000 tons of nickel concentrate, which will be moved out by ship before the winter freeze-up in the fall. Eventually, production will go to the new smelter being built by *Eastern Mining and Smelting Company* at Chicoutimi, Quebec. The North Rankin mine has been developed on two levels to a depth of 300 feet. It is planned to enlarge the workings on the 200 and 300 levels, and also to undertake additional exploration work.

ALASKA—Mining operations were resumed at Long Creek, 28 miles from Ruby, when Pat Savage returned to camp for the season. Mr. Savage has mined in Alaska since 1924. He is presently engaged in a dragline-dozer operation at Long Creek, and is operating this summer with a crew of five.

BRITISH COLUMBIA—*American Smelting and Refining Company* is speeding up its exploration of the *Bethlehem Copper Corporation* property in Highland Valley. An expanded program has been started which will include 10,200 feet of additional diamond drilling, 10,000 feet of churn drilling, some geological and geophysical surveying, comprehensive metallurgical testing, and compiling of preliminary engineering estimates. Concentration of work will be on the Jersey and Iona zones. A *Kennecott Copper Corporation* subsidiary, *Northwestern Exploration Ltd.*, will resume exploratory work under agreement with Bethlehem on another large copper prospect a few miles from this ASARCO operation.

SASKATCHEWAN—First shipments of uranium ore from the *Cayzor Athabaska Mines Ltd.* to the Lorado custom mill in the Beaverlodge area have started. Cayzor has a contract with *Lorado Uranium Mines Ltd.* for delivery up to 1962 of slightly more than 2,730,000 pounds of contained uranium oxide. The Cayzor mine is being developed through a three-compartment shaft with four levels.

ONTARIO—*Faraday Uranium Mines Ltd.* has placed its new mill in operation in the Bancroft area. During the tune-up period the mill has been working at an initial rate of 400 tons per day, treating low-grade ore from the company stockpile. Now the mill is slowly working up to its rated capacity of 1,000 tons per day.

MANITOBA—During the past winter, *Howe Sound Company's* exploration department supervised an electro magnetic survey over 20,000 acres of company

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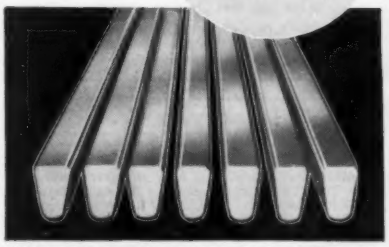

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property in northern Manitoba. Follow-up surface drilling is in progress, and research also is proceeding on a full scale for development of new processes to increase metal discovery and to discover and develop new uses for cobalt. The company will close its *Chelan* division mine at Holden, Washington on June 28, and the *Snow Lake* gold mine in Manitoba will also be shut down.

QUEBEC—*Eastern Mining and Smelting Corporation* has started operation of its $6,000,000 power project at Chicoutimi. This is the first step toward production from the $35,000,000 smelter which is supposed to start in 1958. The power project will supply a minimum of 32,000 primary horsepower, plus 11,000 secondary horsepower. Until completion of the smelter, this power will be sold to *Aluminum Company of Canada;* after the smelter goes into operation, Aluminum Company will receive only surplus power. At the company's *Gordon Lake* property, shaft sinking is making good progress.

ONTARIO—*Coldstream Copper Mines Ltd.'s* new 1,000-ton mill should go into production at any time. Initial mill feed will come from the new deeper levels which grade well above mine average; in fact, mill heads are expected to exceed 3.5 percent copper for some time. A new 100-inch, double-drum Ingersoll-Rand production hoist has been installed to speed up underground work.

BRITISH COLUMBIA—During the first quarter of 1957, *Bralorne Mines Ltd.'s* operations were expanded in the Queen section of the mine, resulting in increased gold production. During the month of March more gold was produced than in any previous month for the past 15 years. Preparations are under way to install the sinking hoist at the 32 level Queen shaft. The shaft is now 30 feet below the 33 level and sinking will start soon.

MANITOBA—*Partridge Canadian Explorations Ltd.* has acquired, by option and staking, about 1,600 acres in the Herb Lake area where outcrops have indicated low values in copper-nickel. *Fathom Drilling Company* of Winnipeg has a contract for 5,000 feet of drilling.

BRITISH COLUMBIA—The old *Elsiehotme* copper property near Wynndel has been sold to the *Imperial Mines and Metals Ltd.* of Edmonton, Alberta. Seller was C. O. Ogilvie who is developing a galena strike on Goat River in the Kitchener area. On Goat Creek, L. H. Bettin of Vancouver has purchased the *Hope* group of claims from E. Bainbridge. He plans to build a road to a galena showing.

QUEBEC—*Cartier Mining Company,* a wholly owned subsidiary of *United States Steel Corporation,* has been granted permission by the Quebec government to establish a hydroelectric power project on the Hart-Jaune River. The project will be developed by another subsidiary, *Hart-Jaune Power Company Ltd.* The plant is to be constructed by January 1, 1960, and the lease extends for 25 years from that date. It can be renewed for two additional 25-years periods. Cartier is developing a low-grade magnetite property which will be brought into production at a cost of about $200,000,000. The run-of-mine ore averages about 30 percent iron. It will be pelletized and upgraded to 60 percent at the mine site. The pelletizing plant is to be in operation by January 1, 1962, and will probably have a capacity of 10,000,000 tons annually.

YUKON TERRITORY — *Canalask Nickel Mines Ltd.* of Toronto has let a contract to Bob Golac of Nelson, British Columbia, to drive a 1,000-foot tunnel on holdings near the Snag Settlement on the Alaska Highway. The tunnel will go under the White River.

NORTHWEST TERRITORIES—*The Photographic Survey Corporation* of Toronto has been awarded a contract to continue the Government's Shoran-controlled survey of Canada's northlands which was begun in 1947 by the *Canadian Geodetic Survey.* Under the contract, the group will obtain lattice photographic coverage of about 40,000 square miles of Baffin Island. Base of the expedition will be an airstrip at Foxe Inlet. The operation airlift begins in early May with actual photography starting about June 1 when enough ice melts to make photography practical. Snow falls throughout the year in this region. For only a few months of the year is snow cover sparse enough to permit photographying of the salient features.

ALASKA—*Minerals, Inc.* has staked a large number of beach placer claims along the shores of the Gulf of Alaska. (Beach sands often contain titanium, iron, gold, and other minerals). One group of 82 claims were staked near the Situk River and another of 156 claims in the vicinity of Lituya Bay.

YUKON TERRITORY—Continued favorable results from the bottom levels of *Galkeno Mines Ltd.'s* operations at Keno Hill have led the management to decide on a program of deeper development work. A low-level adit will be driven from the vicinity of the mill (about 5,000 feet) to tap the ore bodies at a depth of approximately 750 feet below the present main adit. Simultaneously, a two-compartment vertical service shaft will be sunk from the present adit horizon to meet the new adit and provide facilities for handling men and materials to the intermediate levels. Production was resumed at Galkeno in July 1956 and has been averaging about 130 tons of ore milled daily since then. Grade is slightly below 40 ounces silver, 8 percent lead, and 8 percent zinc per ton. There is also some cadmium and a low gold content.

QUEBEC—Through a wholly owned subsidiary, *Union Carbide and Carbon Corporation* is reported to have joined with *Perron Gold Mines* in an exploration of the latter's property in the Ungava nickel district. A sum of $300,000 has been allocated for the exploration program, with each firm putting up 50 percent. A joint airborne electromagnetic survey will be made, followed by geological mapping and sampling on the ground. Perron is controlled by *Little Long Lac Gold Mines Ltd.*

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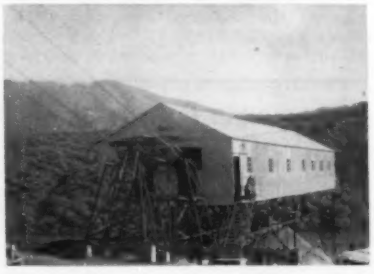

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Personalities

Continued from page 77

Wingfield, who has been prominent in Nevada mining for over 50 years, had been a cowboy until he became interested in the goldrush to Tonapah in 1901. He has also been head of many of Nevada's leading banks.

William Reinhardt has retired from Union Pacific Railroad's department of oil development after 20 years of building it into a multi-million dollar producer. The 72-year-old Mr. Reinhardt has been prominent in mining and in oil and gas production for nearly half a century. The most recent project he has launched is the exploration of a huge iron and titanium deposit now awaiting development in Wyoming. Mr. Reinhardt will maintain his association with the mining industry as a general geological consultant and has made a tentative connection with Cyprus Mines Corporation.

James L. Boyd, vice president of Kennecott Copper Corporation, was chosen to be president of the Copper Club to succeed **Walter E. Beer, Jr.**, **Edward A. Boano** is the new vice president, succeeding Mr. Boyd. **Arthur I. Heim** continues as secretary-treasurer.

Nevada Mining Association officers elected for the 1957 term are **J. C. Kinnear**, honorary president; **F. A. McGonigle**, president; **Charles H. Segerstrom, Jr.**, first vice president; **Roy A. Hardy**, second vice president; **Louis D. Gordon**, executive secretary.

Fred Don Waltman has been appointed superintendent in charge of the mine, separator mill, and kiln of Florida Manganese, Inc. of Deming, New Mexico. He is from Edwards, New York.

Dr. George A. Last, a scientist at the Kennecott Copper Corporation's Research Center, was recently selected by the U. S. Atomic Energy Commission as one of 120 men in the nation to receive a year's training in reactor technology.

A. D. Rood, mining engineer for The Anaconda Company, has been assigned to the office of **Richard S. Newlin**, vice president in charge of operations, in New York. Mr. Rood, a member of the mining department staff at Butte for the past nine years, was in charge of planning the operation of the Kelley mine at Butte. For the past year he has been in Chile, mapping plans for the operation of the new El Salvador mine there.

Leo M. Abell was appointed concentrator superintendent of the Morenci Branch, Phelps Dodge Corporation, succeeding **J. E. Papin**, retired. Mr. Abell was previously research engineer. **George A. Swanson** is the company's new general auditor, Western Operations. He succeeds **John Kuhn**, who retired after 31 years' service with Phelps Dodge.

Four new directors have been named for Highnoon Uranium Mines, Newport, Washington. They are **H. C. Felsman** and **Joe A. Washburn** of Spokane,

A. A. WALLACH, copper mining and ore processing specialist, has joined Kaiser Engineers' development division in Oakland, California as one of the principal engineers. In his new position, Mr. Wallach will be responsible for project analysis in the fields of mining and quarrying, rock products, ore processing, and non-ferrous metals. For the past two years he has been chief metallurgist for the San Manuel Copper Corporation, San Manuel, Arizona, and acted as assistant plant superintendent during start-up operations.

and **Glen Hersey** and **Verne Sauer** of Ione.

Warren R. Wagner, Boise, Idaho geologist, and **Russell C. Cutter**, a geologist in Grand Junction, Colorado, have joined forces to offer their services in exploration, property evaluation, and development, airborne geological surveys, and engineering geology, with the motto "No Job Too Large or Too Small."

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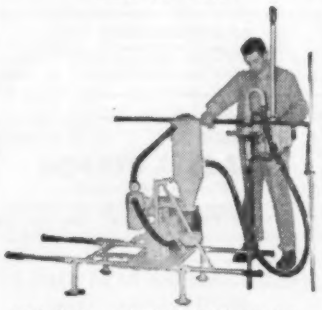

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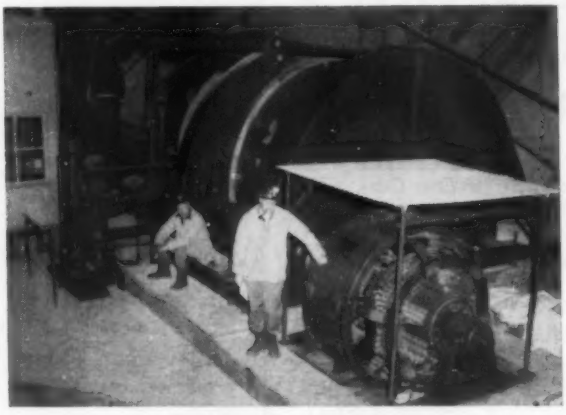

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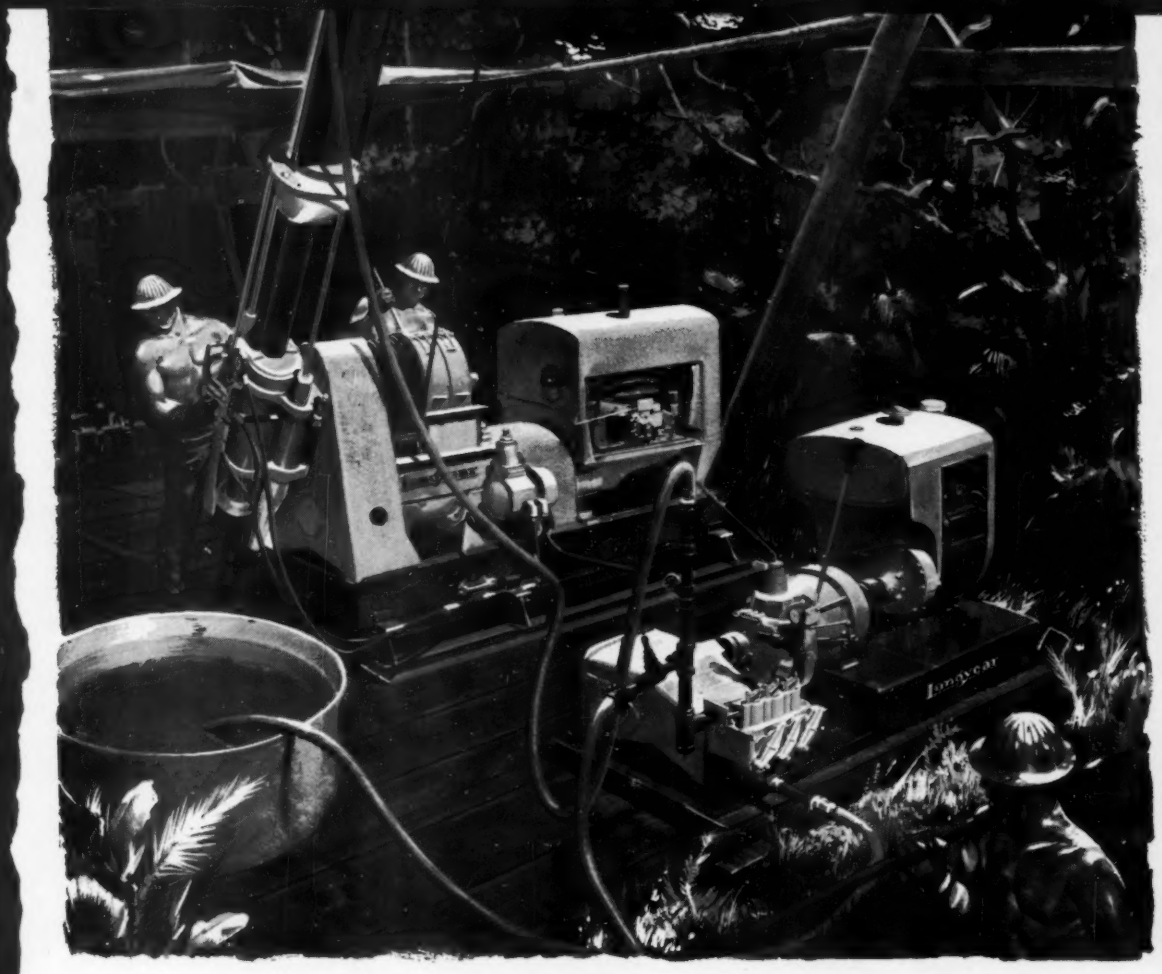

The drill crew **without a pumping problem!**

They depend upon the versatility of a Longyear transmission pump

Today this drill crew started a new hole, pumping as much water as possible through a rock bit. Next week, or next month, they may be pumping 5 gpm at 400-500 psi and doing it *without bypassing . . . without throttling down . . . without changing liners . . . without changing pumps.* Rock bitting or fishtailing, coring at moderate depths or deep hole coring—their Longyear Transmission Pump satisfies *every* drilling condition.

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Because they selected a Longyear transmission pump, this drill crew has three important advantages. They:

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3. Eliminate bypassing, can drill with a closed circuit.

Advantages of Closed Circuit Drilling

Closed circuit drilling permits the use of Longyear Wire Line or "L" series core barrels equipped with water shut off valve.

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Shown in the drilling scene above is the Longyear 535RQ Pumping Unit. Featuring a five-speed transmission, this unit pumps as much as 35 gpm, as little as 4.5 gpm at pressures up to 500 psi. Gasoline powered—also available with Diesel or electric power.

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Experience has shown that you can't overestimate the importance of *selecting the proper pump for the job.*

Longyear offers a complete line of pumping units for every drilling need. We will be happy to send you full information on our entire line of transmission and single-speed pumps.

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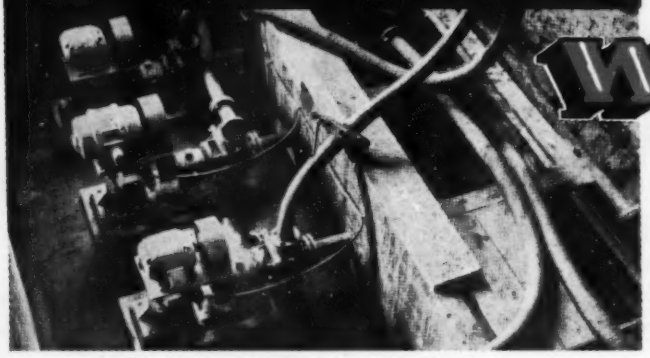
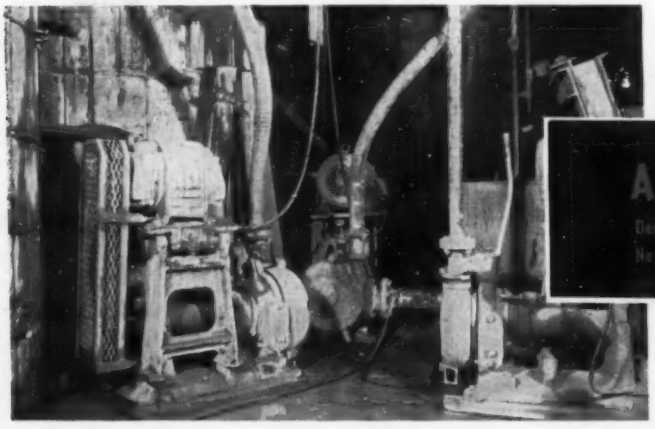


WILFLEY ACID PUMPS receiving vanadium and uranium leach liquors from leach tanks and pumping them to various treatment tanks.

WILFLEY SAND PUMPS receiving the classifier overflow and pumping the material to the sand slime separation circuit.



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